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ABSTRACT

The unit of instruction is designed for use by teachers in planning and conducting young farmer and adult farmer classes. The purpose of this course is to develop the effective ability of farmers to efficiently handle forages for economic livestock feed on Kentucky farms. The unit is divided into five lessons. The lessons deal with the following topics: (1) the extent of mechanization of forage handling desirable in order to produce the most economical feed, (2) harvesting forages by grazing, (3) harvesting and storage forages in barn type structures, (4) harvesting, storing, and feeding silage, and (5) harvesting, storing, and feeding forages in the field. Transparency and handout masters are found at the end of each lesson in the unit. Teaching forms and a unit evaluation questionnaire are appended. (VA)

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Forage Handling

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An Instructional Unit for Teachers of Adult Vocational Education in Agriculture

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CE 005 278

(VT 102 056)

1973

FOREWORD

Mr. Jerry W. Greer, teacher of agriculture at Barren County High School, has taught nine years at Park City High School. Each year he has taught a young-farmer class in which new developments in forage handling were introduced. He has a 20-cow beef herd and is experimenting with different forage-handling methods on his 53-acre farm. Some of the ideas expressed in this unit are a result of his experiences with forage handling mechanization. Mr. Greer has a B.S. degree in Agricultural Education and a M.S. degree in Vocational Education from the University of Kentucky, and 18 hours in School Administration at Western Kentucky University. He has served as a president of the Kentucky Vocational Agriculture Teachers' Association and is active in numerous local and district civic and professional activities and organizations. He is married to the former Nancy Marlow and has two children, Clint and Jamie.

This adult-farmer course is a result of the following sequence of actions:

1) The State Advisory Committee, made up of agriculture teachers, State staff, and teacher educators throughout Kentucky, was organized to determine needs and program direction for adult work in agriculture for the State. A major outcome of the first meeting in September, 1971, was a recommendation that more instructional materials that are specifically designed for teaching adults in agriculture be developed and distributed to teachers.

2) Subsequently, a proposal to involve experienced teachers of adults in material development was written by Dr. Maynard Iverson of the University of Kentucky and submitted for State funding. In January, 1972, a two-year special grant was made through the Supporting Services Division, Bureau of Vocational Education, State Department of Education.

3) Twelve teachers were selected to produce units in the diverse areas of need during the course of the project.

This publication, along with other materials developed specifically for instruction of adults employed in agriculture in Kentucky, should improve the teaching of adult classes in agriculture and stimulate the initiation of additional classes.

Robert L. Kelley, Director
Agribusiness Education
State Department of Education

Harold R. Binkley, Chairman,
Dept. of Vocational Education
University of Kentucky

ACKNOWLEDGEMENT

We are grateful to the following for their valuable assistance with the unit: Mr. Faye R. Atherton, Barren County Agricultural Extension agent, for evaluating the preliminary outline and objectives; Mr. Hampton Hinton, Jr. Assistant Management Specialist, Mammoth Cave PCA, for furnishing references and information on Lesson 1; Mr. Harold Vought, Area Extension Specialist in Crop Production, Mammoth Cave, Kentucky, for helping with references on silage (Lesson 4); Dr. James McGuire, Associate Professor of Agricultural Education, Western Kentucky University, Bowling Green, for suggestions as to general references for the unit; Mr. Earl Wilson, Manager of Mammoth Cave PCA, Glasgow, for references and whose progressive policies inspired the writer to incorporate innovative ideas in mechanization in the unit; Messrs. Jerry and Joe Coleman, Clay Equipment Co., Hiseville, for their cooperation in providing references; Mr. Michael A. Bales, Editor, New Holland News, for graciously allowing use of New Holland Transparency Masters and slides in this unit; Mr. Jaap Kroes, Manager, Vermeer Manufacturing Co., for furnishing slides of the large round baler. The many companies and individuals listed in the Reference Section, for use of their materials; Mr. Warren Thompson, Agronomy Department and Dr. Frank Pattie, Professor Emeritus, both of the University of Kentucky, for critical review of the manuscript; Mr. Ray Gilmore, artist, Curriculum Development Center, University of Kentucky, for art work on the unit; Dr. Robert Schneider, Supporting Services Division, Bureau of Vocational Education, Frankfort, for expediting financing; Mrs. Anne Mills, Secretary, Department of Vocational Education, University of Kentucky, and Ms. Linda Ledford, Ms. Carol Ledford, Ms. Susan Roberts, typists, for their skills in bookwork and typing of the unit, respectively; and especially to the authors and agencies whose materials were so useful in completing the unit.

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SUGGESTIONS FOR USING THE COURSE

This unit was developed as a guide for use by teachers in planning and conducting young-farmer and/or adult-farmer classes. Because of the diversity in age, expertise and experience levels of class members and instructors, the unit was designed to cover the basic areas of forage handling. Therefore, teachers should adapt those portions of the unit that are suited to their particular situation. Five lessons have been included, but the unit may be expanded to more topics or utilized in diversified courses for shorter periods of instruction. It may be helpful to involve class members at the organizational meeting in the selection of lessons and activities. Planning forms to assist in this process are found in the appendix. We highly recommend that the major teacher reference, Crop Production by Delorit and Ahlgren, be secured by anyone planning to utilize this unit.

The format used was designed to assist teachers in utilizing problem-solving and the discussion method. A teaching procedure that has been used successfully follows: Step 1: The teacher lists the topic (problem and analysis) on the chalkboard. Step 2: He then sets the stage for discussion with introductory facts, ideas, or comments, using items from the section on "developing the situation." Step 3: The teacher calls on the class to give their experiences, ideas, and knowledge concerning the subject. The discussion is supplemented with handouts, transparencies, models, or other inputs gathered by the teacher beforehand to help solve the problem under consideration. Resource people or films may also be used here as sources of information. (Transparency and handout masters are found at the end of each lesson in the unit.) Step 4: When the facts have been brought out and a good discussion has taken place, the teacher leads the group to appropriate conclusions. These summary statements are written on the chalkboard and, in some cases, are typed up and distributed as handouts at the next meeting. Some instructors will utilize devices such as panels, exhibits, and tours to reinforce the conclusions reached. Several suggestions for supplementary enrichment activities are listed in each lesson of this unit.

Teachers may want to utilize the wealth of resources found in each community to supplement their teaching -- local forage equipment dealers, representatives of companies manufacturing forage handling equipment, Extension specialists, and others will undoubtedly be pleased to serve as resource people, furnish samples, give demonstrations, conduct tours, arrange for films

and assist with other activities appropriate to the success of the course.

Each teacher using the unit is asked to complete and return the evaluation questionnaire found in the appendix. These ratings and suggestions will be used to improve this unit as well as others developed in the future.

Our best wishes for a successful adult program.

Jerry W. Greer
Development Consultant

Maynard J. Iverson
Project Director

UNIT OBJECTIVES

Major objective: To develop the effective ability of farmers to efficiently handle forages for economical livestock feed on Kentucky farms.

Lesson objective: To develop the effective ability of farmers to:

1. Determine the extent of mechanization of forage handling desirable in order to produce the most economical feed.
2. Harvest forages by grazing.
3. Harvest and store forages in barn-type structures.
4. Harvest, store, and feed silage.
5. Harvest, store, and feed forages in the field

UNIT REFERENCES

Books

Crop Production by Delorit and Ahlgren (Prentice Hall, Inc., Englewood Cliffs, New Jersey) 1967.

Doane's Farm Management Guide, Tenth Edition (Doane's Agricultural Service, Inc., 8900 Manchester, St. Louis, Missouri 63144) 1973.

Other Publications

Agricultural Potentials for Kentucky, College of Agriculture, University of Kentucky in cooperation with the Governor's Council for Agriculture, 1973.

Approved Practices for Forage Crops, The Pennsylvania State University, College of Agriculture, University Park, Pennsylvania, 1972.

Beef Gene Roundup, 1971, University of Kentucky College of Agriculture. Lexington, Kentucky 40506.

Farm Planning Manual for Kentucky Farmers by Allan and Browning (Department of Agricultural Economics, University of Kentucky) 1970.

Farm Utility Buildings, American Association for Agricultural Engineering and Vocational Agriculture (Order from U.K. Instructional Materials Laboratory).

Feeding Dairy Cows, Circular 474-A, University of Kentucky College of Agriculture, Lexington, Kentucky 40506.

Field Mowers, American Association for Agricultural Engineering and Vocational Agriculture (Order from U.K. Instructional Materials Laboratory).

Grass Silage Preservatives, Rutgers - The State University, College of Agriculture, New Brunswick, New Jersey, 1959. Leaflet 210.

Kentucky Agricultural Engineering Handbook, University of Kentucky, Department of Agricultural Engineering, Lexington, Kentucky 40506.

Kentucky Agricultural Statistics, (U.S.D.A. Statistical Reporting Service and Kentucky Department of Markets, Louisville, Kentucky). 1971 Edition.

Low Moisture Silage, Rutgers - The State University, College of Agriculture, New Brunswick, New Jersey, 1964.

Open Hay Storage Building, Plan No. 5879, U.S. Department of Agriculture.

Self-Feeder Tower Silos, Rutgers - The State University, College of Agriculture, New Brunswick, New Jersey.

Structures and Environment Handbook, MWPS-1, (Midwest Plan Service, Iowa State University, Amos, Iowa 50010) 1973.

Successful Farming Vo-Ag Teaching Unit #2, Successful Farming Magazine, Harvesting Issue, June-July, 1972.

UMC Agricultural Guide, (University of Missouri, College Agriculture, Columbia, Missouri 65201) 1972.

Cooperative Extension Publications (Kentucky)

Beef Cattle Industry Facts, Series 9, University of Kentucky Cooperative Extension Services, Lexington, Kentucky 40506, 1972.

Beef Forage Systems ,U.K. Cooperative Extension, 1D-5, 1973.

Corn Silage for Dairy Cattle, University of Kentucky Cooperative Extension Services, Misc. 376.

Making and Feeding Grass Silage by W. P. Garrigus, University of Kentucky Cooperative Extension, Circular 550, 1957.

Renovated Kentucky Bluegrass and Supplementary Pastures for Steers, Bulletin 709, University of Kentucky.

Commercial Publications

Auger Feeders, and

Barn Cleaners, and

Feed Conveyors, and

Forage Blower, and

Forage Boxes, and

Free-Stall Barn Cleaner, and

Heavy Duty Chain Feeder, and

Self-Propelled Feeder, and

Silo Unloader, Badger Northland, Inc., Kaukauna, Wisconsin.

Automated Feeding Systems for Dairy and Beef Cattle, MF-308 and SU/MF-304, and

Barn Cleaners, Bulletin BC-308, and

"Roller Beef" Belt Line Feeder, Bulletin BF-305, and

Silo Unloader Systems, SU-311, Clay Equipment Corp., Cedar Falls, Iowa.

Concrete Improvements for Farm and Ranch, (POrtland Cement Association, 33 West Grand Avenue, Chicago, Illinois 60610) 1965.

Gerber Monocrete Silo, Gerber Concrete Products Co., Syracuse, Indiana.

Hay and Forage Harvesting, and

Haylage Silage Handbook, (New Holland, Division of Sperry Rand Corp., New Holland, Pennsylvania 17557), 1969.

Machinery Management, John Deere Service Publications, Department F, John Deere Road, Moline, Illinois 61265. (available April, 1974)

Hesston Stack Hand Systems, and

The Care and Feeding of Hesston Haystacks, Hesston Corp., Hesston, Kansas 67062.

Horizontal Box Silos, USS Cresote, United States Steel Corporation.

Kentucky Silos, Kentucky Silo and Equipment Co., Inc., Franklin, Kentucky.

Lease, Mammoth Cave PCA Equipment Leasing Service, Smiths Grove, Kentucky 42171, 1973.

Long Silos, Long Silo Co., Inc., Shelbyville and Princeton, Kentucky.

Pole Barn Storage of Hay, 1973, and

Haymakers Handbook, and

Haymakers Handbook Teaching Kit, and

Haymakers Record Book, (New Holland, Division of Sperry Rand Corp., New Holland, Pennsylvania 17557).

The Lazy Susan Silage Feeder, Indiana Silo Co., R.R. 6, Shelbyville, Indiana.

Vermeer Hay Balers, Vermeer Manufacturing Company, Pella, Iowa, 50219.

Films/Slides

"Best Move You Can Make," Hesston Corporation.

"Haymakers," New Holland.

"Use-It-All-Beef," A.O. Smith, Harvestore Products, Inc.

Lesson 1

ECONOMICS OF FORAGE MECHANIZATION

Objective -- To develop the effective ability of farmers to determine the extent of mechanization of forage handling desirable in order to produce the most economical feed.

Problem and Analysis -- How can we determine the extent of mechanization required to handle forages most economically?

-Reasons for mechanization
-Determining cost of ownership
-Economics of leasing
-Hiring custom work

Content

I. Reasons for Mechanization

A. Traditionally, harvesting forages has required a lot of labor.

B. Labor costs are increasing each year.

C. Competent, dependable labor is not available to many farmers.

D. Replacing labor with machines permits the farm manager to have more time for wise decision-making, which is his most important task.

E. Increased mechanization can increase total farm operation.

F. A farmer can mechanize forage production by purchasing, leasing, or renting or hiring custom work.

II. Determining Costs of Ownership

A. One should ask himself the following questions before investing in machinery:
   1. Will your investment permit you to operate more effectively than you could without it?
   2. Will you be able to produce as good or better products than you could without it?
   3. Will you increase your operating efficiency?
   4. Will your added investment be offset by reducing the required labor force needed on your farm or permit you to use your labor more productively?
   5. Will you be able to increase your overall net income?

B. A farmer should purchase machines that have the following characteristics:
   1. Low fixed costs and high variable costs
   2. Frequent use required
   3. Timeliness of use is important

NOTE: Machines that do not have these characteristics may be leased or custom hired more economically.

C. Depreciation for tax purposes is a factor to consider in determining whether to purchase equipment. One can use the straight-line method or one of the accelerated methods such as sum-of-the-years digits or declining balance.

D. Investment credit for tax purposes may encourage farmers to purchase equipment. The tax law of investment credit changes frequently, so the publication, Income Tax Guide for Farmers, should be reviewed in order to know what is allowed.

E. The D.I.R.T.I. formula can help the farmer decide whether to purchase equipment:
   D - Depreciation
   I - Interest
   R - Repairs
   T - Taxes
   I - Insurance
   1. If the farmer estimates the cost of each of

these factors and their total is about the same as the cost of other methods of acquiring the machinery, he probably should purchase the machine.

2. Example: A machine costing $10,000.00 which can be leased for $2,000.00 per year-

D =	$1,000.00
I =	800.00
R =	200.00
T =	25.00
I =	75.00
Total	$2,100.00

III. Economics of Leasing

A. The terms, renting and leasing, are used interchangeably. They can involve securing machinery for one or more days for a specific job or for for one or more years. We will use the more common term of leasing in this unit.

1. Machinery may be leased from machinery companies, dealers, individuals, and leasing companies.
2. Equipment probably should be leased if it is used infrequently and fixed costs are high.
3. One should be sure that equipment will be available when he needs it.
4. One must allow for costs and time of transportation on leased equipment. He should also allow for fuel and repair costs if he is required to pay for these items.
5. The following information is contained in a brochure from Mammoth Cave P.C.A.'s Equipment Leasing Service. The rates quoted were for the 1973 crop year. (See master 4.)

IV. Hiring Custom Work

A. The following are some advantages in hiring custom work with machinery.

1. Frees capital for other uses.
2. Most custom operators are skilled.
3. Seasonal labor problem eased.
4. Cost is directly tax-deductible.
5. No ownership risks.
6. No personal property tax or insurance to

pay.

B. The following are some disadvantages in hiring custom work with machinery.
   1. Good custom operators are hard to find during the busy season.
   2. Custom work must be scheduled in advance.
   3. A poor operator increases losses.
   4. Late harvesting may affect yield and quality.

C. Custom rates will vary from one location to another. The following table may be used as a guide.

CUSTOM RATES FOR FARM JOBS IN KENTUCKY, JUNE 1970*

Operation	Range in Rates
Mowing (per acre)	$1.75 - 2.50
Raking (per acre)	1.25 - 2.00
Conditioning (per acre)	1.50 - 2.50
Windrowing (SP) (per acre)	2.50 - 3.00
Pick-up baling (per bale)	
Twine	.12 - .20
Wire	.18 - .25
Hay handling (per bale)	
Haul to barn and store	.10 - .15
Cut, rake, bale, and store	.35 - .45

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher: (Ask questions such as the following.)
   1. What can we do to solve labor problems associated with forage harvesting and storage?
   2. What benefits are derived from using machines to replace labor?
   3. How can we secure machinery needed in forage harvesting and storage?

B. Things to be brought out by class members:
   1. How serious is their labor problem?

* SOURCE: Kentucky Agricultural Engineering Handbook

2. What are their future plans as to the need for harvested forages?
3. Can yield and quality be improved by mechanizing forage harvesting and storage?

II. Conclusions

A. As labor becomes more scarce and expensive, machines must be used to harvest and store forages.

B. One should purchase machinery that has low fixed costs, high variable costs, is used frequently, and requires timeliness of use.

C. Depreciation and investment credit are advantageous factors to consider in machinery ownership.

D. Machines may be leased if fixed costs are high and machines are used infrequently. Transportation and repairs must be considered before leasing.

E. Hiring custom work is desirable to free capital and labor. Securing work at the proper time is an important factor in hiring custom work.

III. Enrichment Activities

A. Demonstrate how to figure different methods of depreciation and investment credit.

B. Invite farm-loan representatives to speak to the class on financing farm machinery.

C. Have the class figure costs of hiring custom work to harvest their forages.

D. Invite a custom operator to speak to the class about his work.

E. Invite an equipment-leasing representative to discuss his leasing program.

IV. Suggested Teaching Materials

A. References for Lesson 1
1. Doane's Farm Management Guide, pp. 249-250.

2. Kentucky Agricultural Engineering Handbook, Section D.
3. Lease, Mammoth Cave P.C.A. Equipment Leasing Service.
4. Successful Farming Vo-Ag Teaching Unit #2 - Machinery Management, Lessons 1 and 2.

B. Resource personnel
1. Mr. Hampton Henton, Jr., Mammoth Cave P.C.A.
2. Mr. Earl Taute, Mammoth Cave P.C.A.
3. Machinery company representatives
4. Local custom operators
5. Cooperative Extension Specialists in Agricultural Engineering and Agricultural Economics

C. Audio-visuals
1. Masters*
-1 Machinery Investment Questions
-2 Requirements for Economical Forage Machine Ownership
-3 The D.I.R.T.I. Formula
-4 Cost Comparisons: Hiring vs. Ownership
-5 Advantages of Hiring Custom Work
-6 Disadvantages of Hiring Custom Work
-7 Custom Rates
-8 Fixed Costs
-9 Operating Costs
-10 Machinery Cost Analysis
-11 Livestock Numbers and Production

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*Masters are keyed to units and lessons, and are numbered consecutively. The code number appears in the lower right hand corner. Master 108-1-1 indicates: adult unit 108, lesson 1, item 1.

MACHINERY INVESTMENT QUESTIONS

1. Will your investment permit you to operate more effectively than you could without it?

2. Will you be able to produce as good or better products than you could without it?

3. Will you increase your operating efficiency?

4. Will your added investment be offset by reducing the required labor force needed on your farm or permit you to use your labor more productively?

5. Will you be able to increase your overall net income?

Adapted from Machinery Management, Successful Farming teaching unit #2.

108-1-1

REQUIREMENTS FOR

ECONOMICAL FORAGE MACHINE OWNERSHIP

1. LOW FIXED COSTS AND HIGH VARIABLE COSTS

2. FREQUENT USE REQUIRED

3. TIMELINESS OF USE IS IMPORTANT

Adapted from Machinery Management, Successful Farming teaching unit #2.

108-1-2

THE D. I. R. T. I. FORMULA

The D. I. R. T. I. formula can help the farmer decide whether to purchase equipment.

D - Depreciation
I - Interest
R - Repairs
T - Taxes
I - Insurance

If the farmer estimates the cost of each of these factors and their total is about the same as the cost of other methods of acquiring the machinery, he probably should purchase the machine.

Example: A machine costing $10,000.00 which can be leased for $2,000.00 per year -

D =	$1,000.00
I =	800.00
R =	200.00
T =	25.00
I =	75.00
Total	$2,100.00

108-1-3

COMPARE THE COST OF OWNING, CUSTOM HIRING & LEASING

EQUIPMENT	MINIMUM COST OF OWNING (Depreciation, Interest, Repairs, Insurance & Taxes)	CUSTOM HIRE (Area Rates)	PCA LEASING/RENTING
Tractor & Bog Disk (100 H.P.) 150 acres	$5.25 per acre	$6.00 per acre	$8.00 per hour for tractor 2.00 per acre for disk 2.00 per hour for your time = $4.25 per acre
Tractor & 5 Bottom Plow 150 acres	$6.00 per acre	$7.00 per acre	$8.00 per hour for tractor 2.00 per acre for plow 2.00 per hour for your time = $4.75 per acre
Haystacker/Baler Based on 50 acres/3 ton	$35.00 per stack	$25.00 per stack	$12.00 per stack 8.00 per hour for tractor 2.00 per hour for your time = $15.25 per stack
Big Round Baler Based on 50 acres/1800 lb.	$11.00 per bale	None Availiable	$5.00 per bale 4.50 per hour for tractor 2.00 per hour for your time = $6.20 per bale
Corn Planter (No-till) Based on 75 acres	$9.49 per acre	$6.00 - $7.50 per acre	$4.00 per acre 4.50 per hour for tractor 2.00 per hour for your time = $5.60 per acre

NOTE: Cost of owning is an estimate. You should analyze your own farm situation to determine actual cost.

INDIVIDUAL EQUIPMENT RATES

TRACTORS:	*Rate	Minimum Daily Charge
New 4020 John Deere (s)	$8.00 per hour	$25.00
Used 4020 John Deere	$8.00 per hour	$25.00
Used 1100 M.F.	$8.00 per hour	$25.00
5000 Ford	$4.50 per hour	$25.00
2020 John Deere	$4.50 per hour	$25.00
PLOWS:		
5 Bottom	$2.00 per acre	$25.00
4 Bottom	$2.00 per acre	$25.00
3 Bottom	$2.00 per acre	$25.00

DISKS:	*Rate	Minimum Daily Charge
New Bog Disk (11 ft.)	$2.50 per acre	$25.00
Used Bog Disk (11 ft.)	$2.00 per acre	$25.00
Conventional Disk (11 ft.)	$2.00 per acre	$25.00
Offset Disk	$2.50 per acre	$25.00
HAY EQUIPMENT:		
2-Big Stacker (3 ton)	$12. per stack	$25.00
Small Stacker (1¼ ton)	$7.00 per stack	$25.00
3-Round Baler (1800#)	$5.00 per bale	$25.00
Hay Mover	$2.00 per stack	none
New Holland Haybine (7ft.)	$4.00 per acre	$25.00

NO-TILL CORN PLANTERS:

	*Rate	Minimum Daily Charge
6 Row (30")	$4.50 per acre	$25.00
4 Row (38")	$4.00 per acre	$25.00
4-New 4 Row	$4.00 per acre	$25.00

*1. Equipment to be leased to PCA members only.
2. All equipment priced to be picked up and delivered back to the leasing headquarters which is Smiths Grove (Stockyard). There will be a transportation charge of 50¢ per loaded mile with a $10.00 minimum on hauling and pulling equipment if done by PCA personnel and equipment.
3. "Sunshine Charge" - The minimum daily charge will be assessed when the farmer has the equipment in his possession when it is work weather even though the equipment may not be in use.

SOURCE: Lease, Mammoth Cave PCA.

ADVANTAGES OF HIRING CUSTOM WORK

1. FREES CAPITAL FOR OTHER USES
2. MOST CUSTOM OPERATORS SKILLED
3. SEASONAL LABOR PROBLEM EASED
4. COST IS DIRECTLY TAX DEDUCTIBLE
5. NO OWNERSHIP RISKS
6. NO PERSONAL PROPERTY TAX OR INSURANCE TO PAY

Adapted from Machinery Management, Successful Farming teaching unit #2.

108-1-5

DISADVANTAGES OF HIRING CUSTOM WORK

1. GOOD CUSTOM OPERATORS HARD TO FIND DURING BUSY SEASON

2. CUSTOM WORK MUST BE SCHEDULED IN ADVANCE

3. A POOR OPERATOR INCREASES LOSSES

4. LATE HARVESTING MAY AFFECT YIELD AND QUALITY

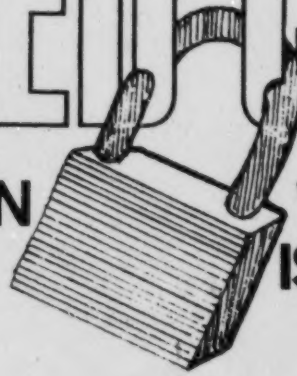
CUSTOM RATES FOR FARM JOBS IN KENTUCKY, JUNE 1970

OPERATION	RANGE IN RATES
MOWING (PER ACRE)	$ 1.75 - 2.50
RAKING (PER ACRE)	1.25 - 2.00
CONDITIONING (PER ACRE)	1.50 - 2.50
WINDROWING (SP) (PER ACRE)	2.50 - 3.00
PICK-UP BALING (PER ACRE)	
TWINE	.12 - .20
WIRE	.18 - .25
HAY HANDLING (PER BALE)	
HAUL TO BARN AND STORE	.10 - .15
CUT, RAKE, BALE AND STORE	.35 - .45

SOURCE: Kentucky Agricultural Engineering Handbook.

108-1-7

FIXED COSTS



LOCKED IN WHEN MACHINE IS BOUGHT

Depreciation

Insurance

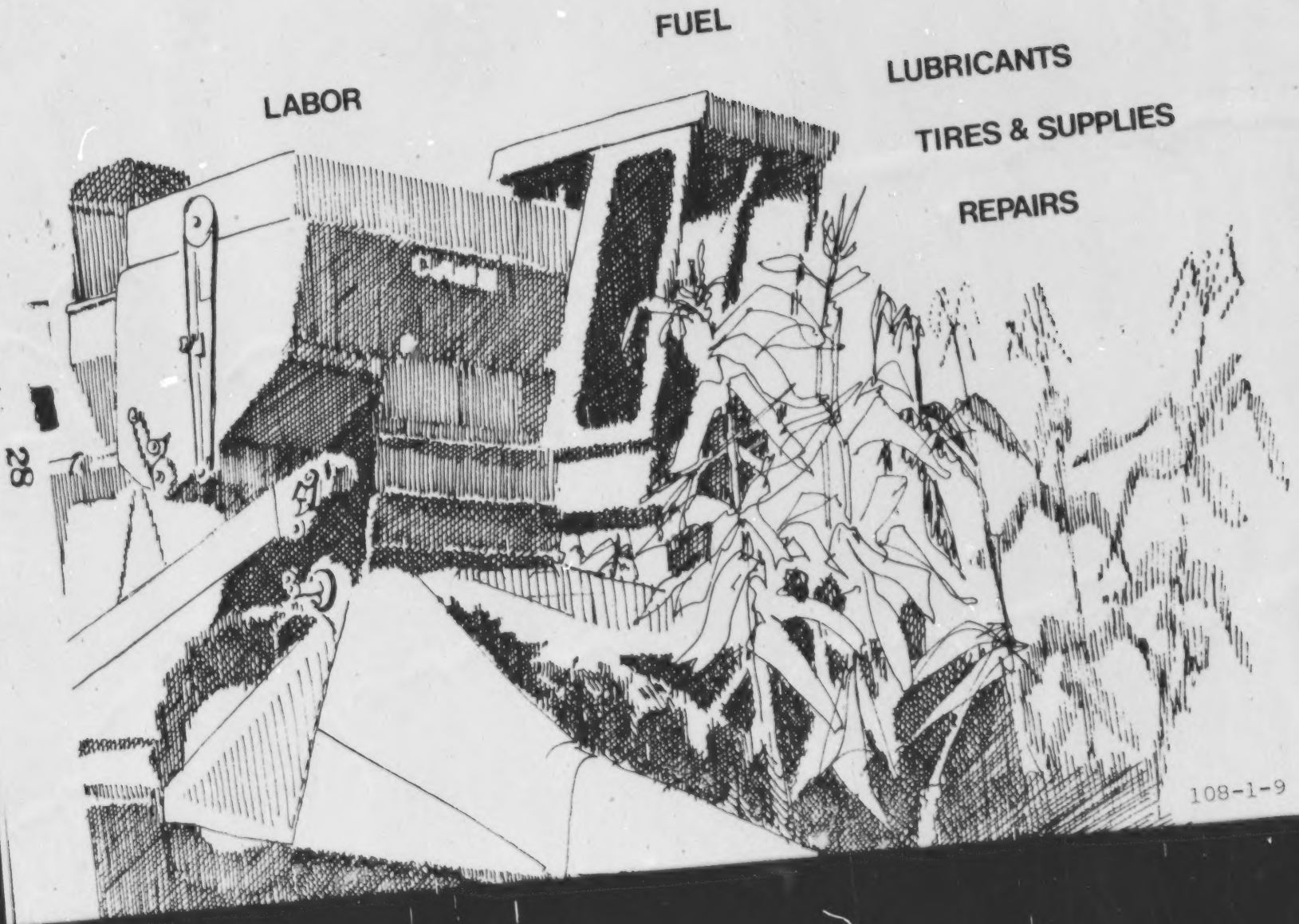
Interest

Taxes

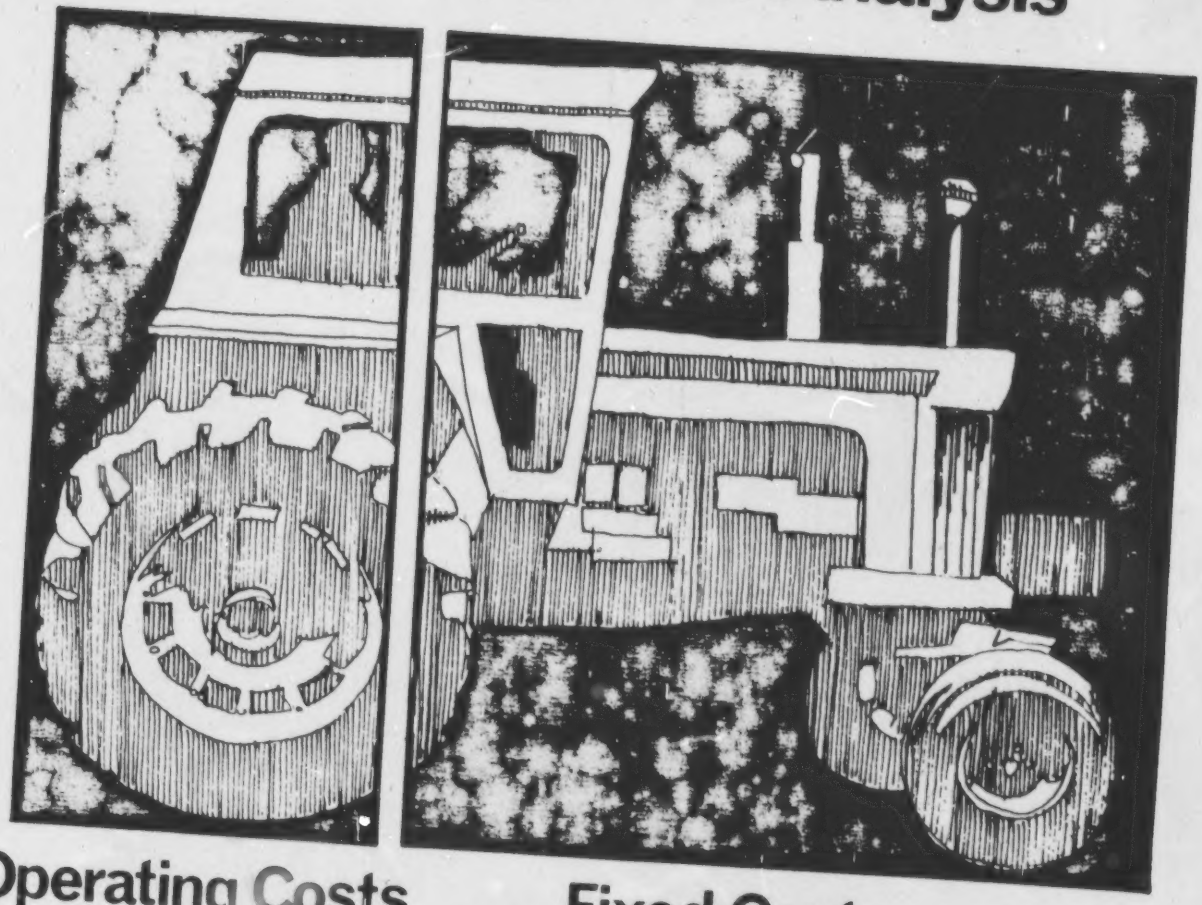
Housing

Amount of fixed cost is set by someone other than the owner.

OPERATING COSTS



Machinery Cost Analysis

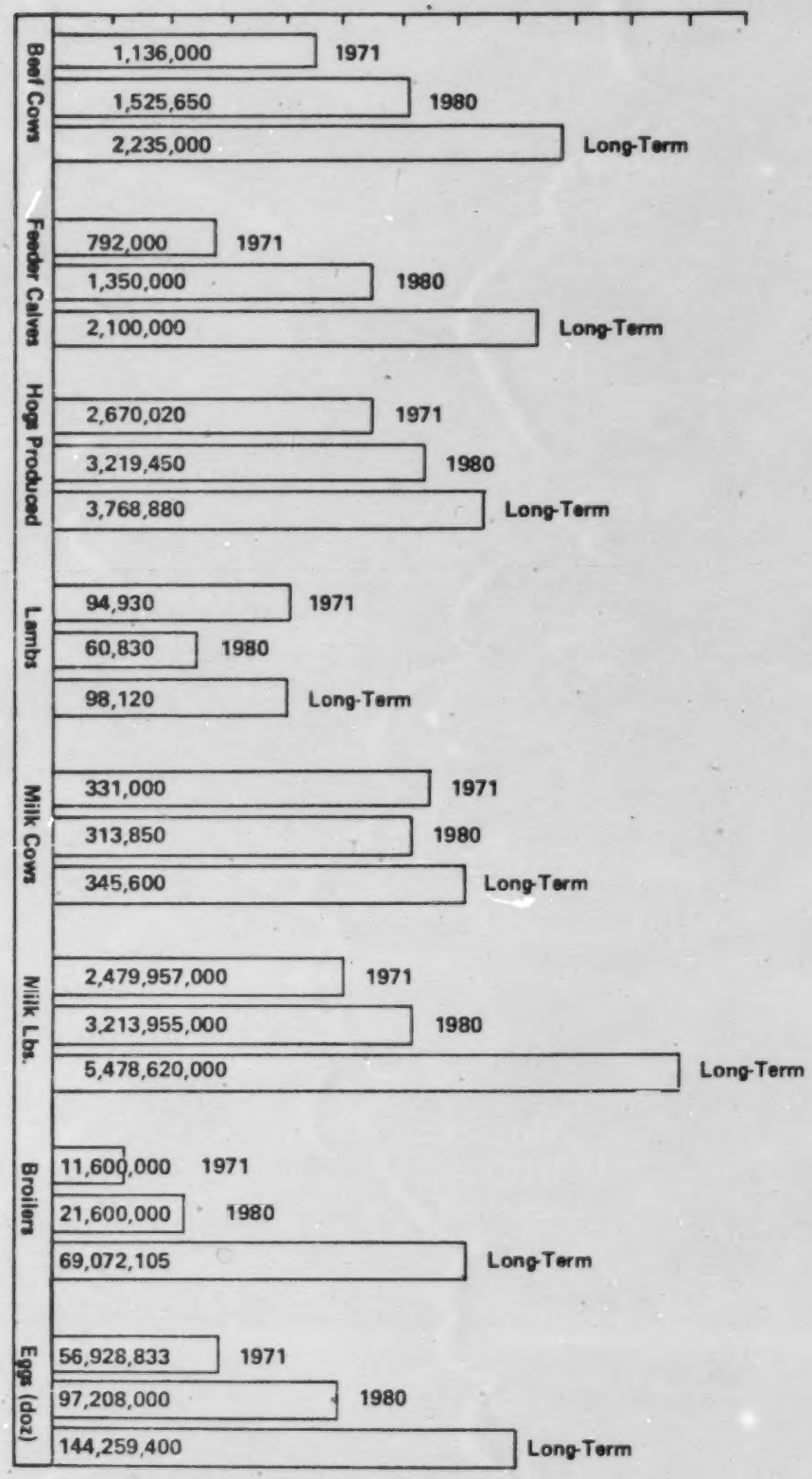


Operating Costs
20%

Fixed Costs
80 %

Top managers are extra careful to keep fixed costs low.

LIVESTOCK NUMBERS AND PRODUCTION



108-1-11

Lesson 2

HARVESTING FORAGES BY GRAZING

Objective -- To develop the effective ability of farmers to harvest forages by grazing.

Problem and Analysis -- How should we harvest forages by grazing?

-Economics of grazing
-Rotational grazing
-Supplemental or temporary grazing

Content

I. Economics of Grazing

A. Many studies have shown that forage harvested by grazing is the most economical source of feed on the farm.
   1. Grazing should be done mostly on low value land.
   2. The savings in labor and equipment make grazing an economical method of feeding.

B. Other advantages to be had from harvesting forages by grazing:
   1. Healthier and cleaner livestock than when animals are confined.
   2. More minerals, vitamins, and proteins in young forages and higher digestibility than in the same forages harvested later as hay.
   3. Increased humus in the soil and less soil loss by erosion.
   4. Less reduction in feeding value because of destructive influences, such as bleaching by the sun and loss of leaves, which often

occurs in haymaking, particularly when weather conditions are unfavorable.

C. An abundant supply of pasture land is available in Kentucky.
   1. Pastures, permanent and cropland, occupy over 9 million acres in Kentucky.
   2. Pastures, harvested forage crops and cornstalks produce over 18 million tons of feed in Kentucky. This is enough to feed over 3 million cows. There were 3.17 million cattle and horses on Kentucky farms in 1973. A slight decrease in area but a 10-20% increase in yield is projected.

FEED PRODUCTION IN KENTUCKY

	ACREAGE	TONNAGE
	(millions)	
Permanent Pasture	4.5	4.1
Cropland Pasture	4.5	9.0
Hay	1.6	3.2
Annual Pasture	.2	.4
Cornstalks	.5	1.2
	11.3	17.9

II. Rotational Grazing

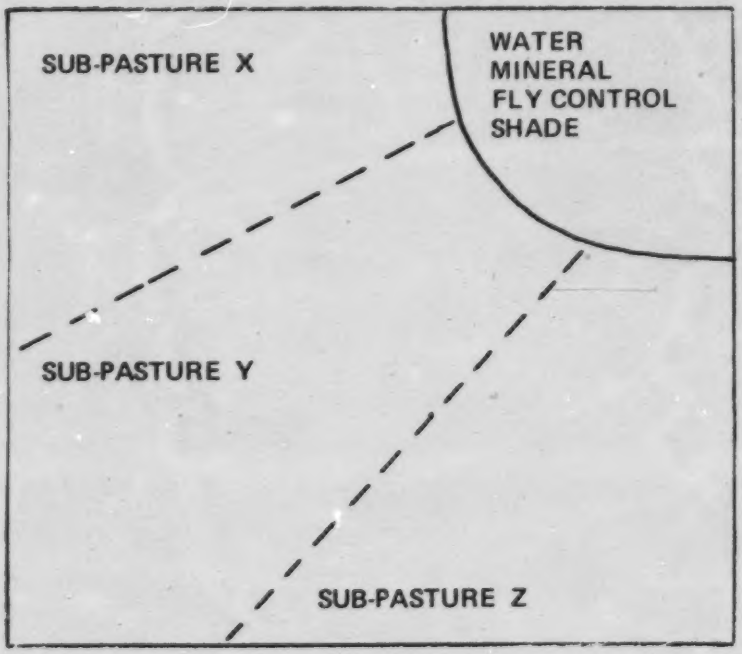
A. Rotational grazing provides for:
   1. Greater uniformity in the quality of crop produced.
   2. Greater efficiency in the grazing and utilization of the pasture crop.
   3. More vigorous plants.
   4. Better maintenance of the erect, productive, and more palatable plant species in the pasture stand.
   5. A frequent change of territory for animals, which may tend to increase consumption of forages.

6. Excess which can be harvested and stored as silage or hay for crisis period feeding.

B. Movement of animals depends upon plant growth rate.
   1. Animals may be permitted to graze entire area early when forage is short.
   2. The area should be divided into at least three sub-pastures. Electric fencing is one economical method.
   3. As forage growth increases, animals should be limited to one sub-pasture, thereby starting the rotational cycle. The two or more other areas are then allowed to recover.
   4. Animals should be rotated even during periods of rapid plant growth.
   5. Routine clipping should be done after grazing a sub-pasture in order to remove seed heads and weeds. This will usually stimulate vegetative plant growth and also conserve fertility and moisture.
   6. Fertilizer may be applied as needed after grazing and clipping.

C. Adequate shade, water and free-choice mineral supplements (salt, etc.) should be available in each sub-pasture to be grazed.

FENCE FOR ROTATIONAL GRAZING

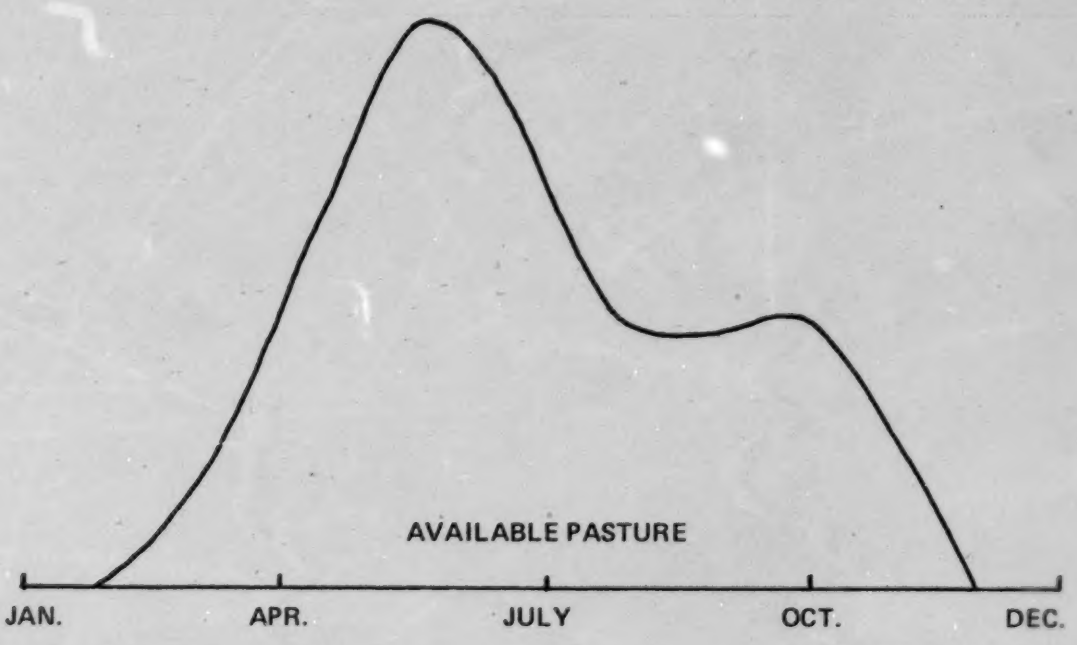


III. Supplemental or Temporary Grazing

A. Fields used for grazing when the permanent or rotational pastures are unproductive are commonly referred to as supplemental or temporary pastures.

B. Many farmers stock only the number of animals that permanent or rotational pastures will feed during July through October months (refer to Table below). More animals can be fed for a longer period of time if one plans supplemental or temporary grazing as part of his grazing program, or harvest surplus feed for crisis period feeding.

GENERALIZED PASTURE AVAILABILITY CURVE FOR COOL SEASON PERENNIAL GRASSES



1. Summer annuals such as Sudan grass or Sorghum-Sudan grass grow well during warm, dry weather and produce a lot of forage in a short period of time. Rotational grazing of these crops is a must in order to utilize them most efficiently.
2. Sometimes grazing of fields used for hay is

desirable. It is a good practice to graze alfalfa fields after they have become dormant. This aids in preventing overwintering of the alfalfa weevil, thereby reducing infestation the next spring.

3. Small grain crops can be grazed in late fall or early spring without reducing grain yields, if grazing is done before plants begin to joint. Cover crops can be grazed closer than crops used for grain.
4. Deferred grazing can be done on fescue or bluegrass if growth has accumulated during summer months.
5. Stalk fields can be grazed during the fall or winter after corn has been harvested for grain. Because of early deterioration, these stalks should be grazed early.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. This lesson is about harvesting forages by grazing and does not include forage production practices except as they relate to harvesting.
2. Beef cattle are better adapted for more grazing than dairy cattle because of their less critical nutrient demands. This is especially true during the months that pasture plants are not producing.
3. Beef cows should not be kept fat during winter months. A winter weight loss is expected if cows enter the winter in good condition.

B. Things to be brought out by class members:
1. Interest in producing livestock and livestock products as efficiently as possible.
2. Interest in reducing labor involved in feeding livestock forages.
3. Knowledge of how to meet the nutrient needs of beef and dairy cattle at various stages of growth.
4. Present stocking rate of class members who are now grazing forages.
5. Potential forages produced on the class member's farms which could be harvested by grazing.

6. Percentage of land on class members' farms that is suited only to grazing.
7. Number of class members who are now using rotational grazing.
8. Number of class members who are now providing supplementary grazing.

II. Conclusions

A. Grazing is the most economical method of harvesting forages because of reduced labor and machinery costs.

B. Healthier animals, minimum loss of nutrient value and soil conservation benefits are the results from harvesting forages by grazing.

C. Tall growing grasses should be substituted for short grass wherever possible; this gives more options: grazing, chopping, stacking, etc.

D. Rotational grazing using electric fences permits greater use of pasture as feed.

E. Supplemental or temporary grazing allows one to graze more cattle, graze more months per year, and better utilize the feed produced on his land.

III. Enrichment Activities

A. Conduct a panel discussion, in class, of farmers in the area who do a good job of harvesting forages by grazing. The teacher should act as moderator and direct discussion questions to panel members. Prepare questions in advance and send them to panel members before the class meeting. Encourage questions from the class members.

B. Take a summer field trip to some farms that do a good job of harvesting forages by grazing.

C. Invite a specialist in forages to speak to the class.

D. Take class members to a Grassland Conference or Field Day during the summer.

IV. Suggested Teaching Materials

A. References for Lesson 2

1. Beef Cattle Industry Facts, Series No. 9, University of Kentucky, pp. 7, 11.
*2. Beef Forage Systems, ID-5, University of Kentucky.
*3. Beef Gene Roundup, University of Kentucky and Broadbent Farms (Ask for article on "Grazing Techniques of Deferred and Accumulated Forage for Wintering the Spring Calving Beef Cow Herd."), mimeo.
*4. Crop Production, Third Edition, Prentice-Hall, Inc., pp. 495-497, 499, 501.
5. Doane's Farm Management Guide, Doane Agricultural Service, pp. 131-132, 135-138.
6. Feeding Dairy Cows, Circular 474-A, University of Kentucky, p. 15.
7. Kentucky Agricultural Statistics, 1971, pp. 55.
8. Renovated Kentucky Bluegrass and Supplementary Pastures for Steers, Bulletin 709, University of Kentucky.
9. U.M.C. Agricultural Guide, University of Missouri, pp. 4610, 4642, 4646, 4649, 4660.

B. Resource Personnel

1. Dr. Curtis Absher, Extension Specialist in Beef, Princeton, Kentucky.
2. Dr. J. K. Evans, Extension Forage Specialist, Lexington, Kentucky.

C. Audio-visuals

1. Masters
   - -1 Pastures
   - -2 Hay Crops
   - -3 Estimated Feed Production Potential in Kentucky
   - -4 Fenced for Rotational Grazing
   - -5 Pasture Availability Curve
   - -6 Strip Grazing of Deferred and Accumulated Growth
   - -7 Cow-forage Calendar Clock

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*Indicates most useful references.

PASTURES

	Grass and Legume	Sudan
Estimated Value	1.5 tons dry matter @ $8.35 $ 12.50 (90 animal-unit days of grazing)	4.5 tons dry matter @ $8.35 $ 37.50 (250 animal-unit days of grazing) (July - August)
Cost Items		
Cash Costs—		
Fertilizer and lime	$ 6.00	$ 24.00
Seed	1.50	4.00
Machinery operation	2.00	6.00
Total	$ 9.50	$ 34.00
Overhead Costs—		
Depreciation (machinery)	$ 1.20	$ 4.50
Interest	.80	2.00
Total	$ 2.00	$ 6.50
Total All Costs—	$ 11.50	$ 40.50
Labor Required - (hours)		
January - March	---	---
April - June	.8	---
July - September	.7	3.5
October - December	---	---
Total	1.5 hours	3.5 hours
Capital Investment	$ 12.00	$ 45.00

SOURCE: Farm Planning Manual for Kentucky Farmers

108-2-1

HAY CROPS

	Alfalfa	Red Clover	Lespedeza
Estimated Value	4.5 tons @ $25 = $110.00	2.5 tons @ $20 = $ 50.00	1.5 tons @ $18 = $ 27.00
Cost Items			
Cash Costs—			
Fertilizer and lime	$ 16.00	$ 9.50	$ 8.50
Seed and etc.	12.00	2.00	2.50
Chemicals	14.00	---	---
Machinery operation	15.00	12.50	6.50
Total	$ 57.00	$ 24.00	$ 17.50
Overhead Costs—			
Depreciation (mach & equip.)	$ 6.00	$ 6.00	$ 4.20
Interest	$60 @ 4% = 2.40	$60 @ 4% = 2.40	$45 @ 4% = 1.80
Storage	4.60	2.60	1.50
Total	$ 13.00	$ 11.00	$ 7.50
Total All Cost—	$ 70.00	$ 35.00	$ 25.00
Labor Required - (hours)			
January - March	---	---	.5
April - June	6.5	6.6	---
July September	3.5	1.4	4.5
October - December	---	---	---
Total	10.0 hours	8.0 hours	5.0 hours
Capital Investment	$ 60.00	$ 60.00	$ 45.00

SOURCE: Farm Planning Manual for Kentucky Farmers

108-2-2

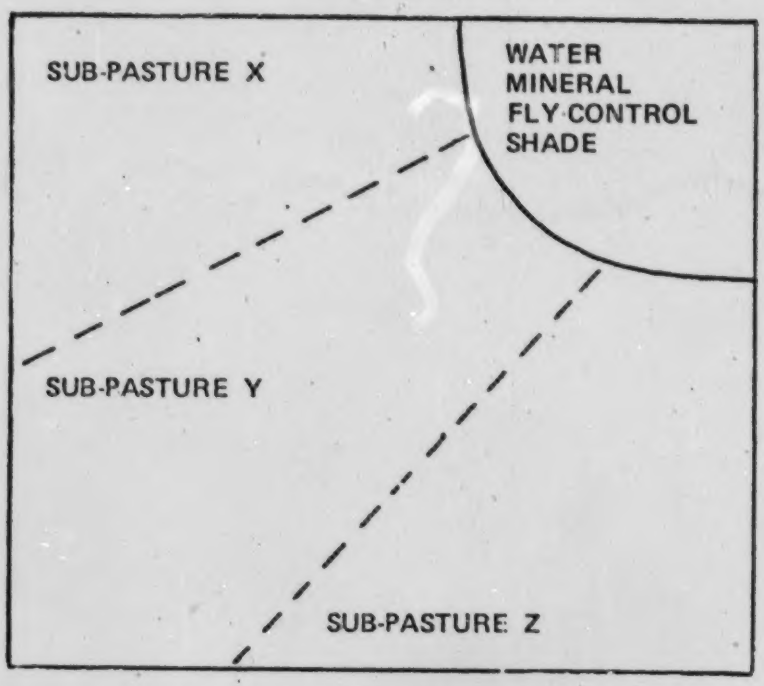
ESTIMATED FEED PRODUCTION IN KENTUCKY

	Acreage	Tonnage
	(Millions)	
Permanent Pasture	4.5	4.1
Cropland Pasture	4.5	9.0
Hay	1.6	3.2
Annual Pasture	.2	.4
Cornstalks	.5	1.2
	11.3	17.9

SOURCE: Beef Cattle Industry Facts

108-2-3

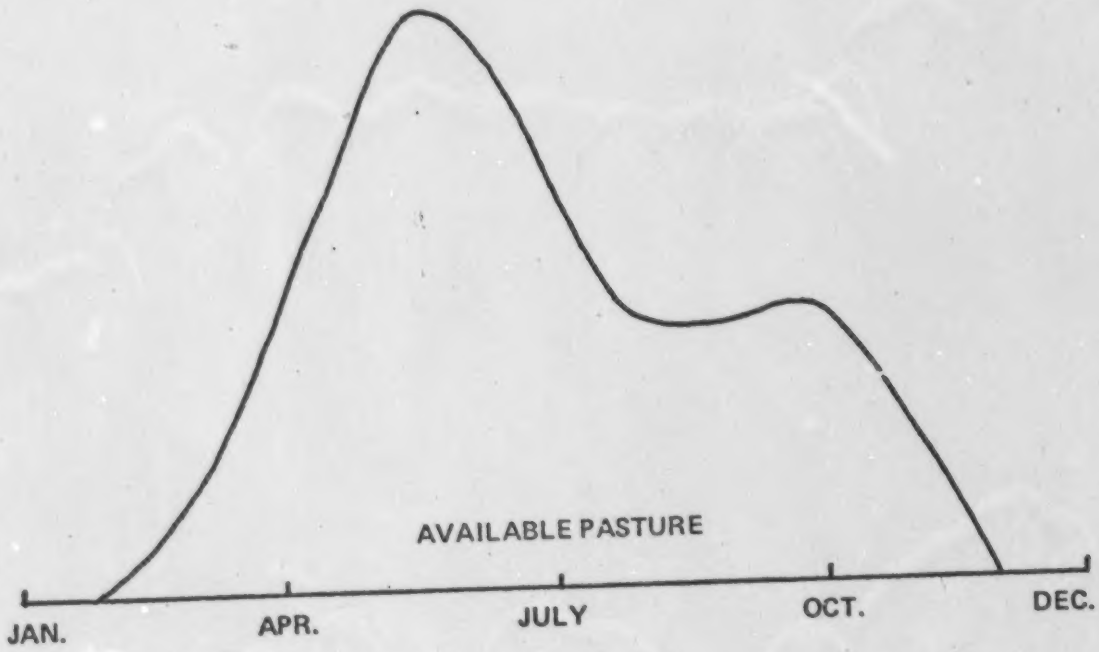
FENCED FOR ROTATIONAL GRAZING



SOURCE: Beef Forage Systems

108-2-4

GENERALIZED PASTURE AVAILABILITY CURVE FOR
COOL SEASON PERENNIAL GRASSES



SOURCE: Templeton, et al. 1970. University of Kentucky Bulletin 709.

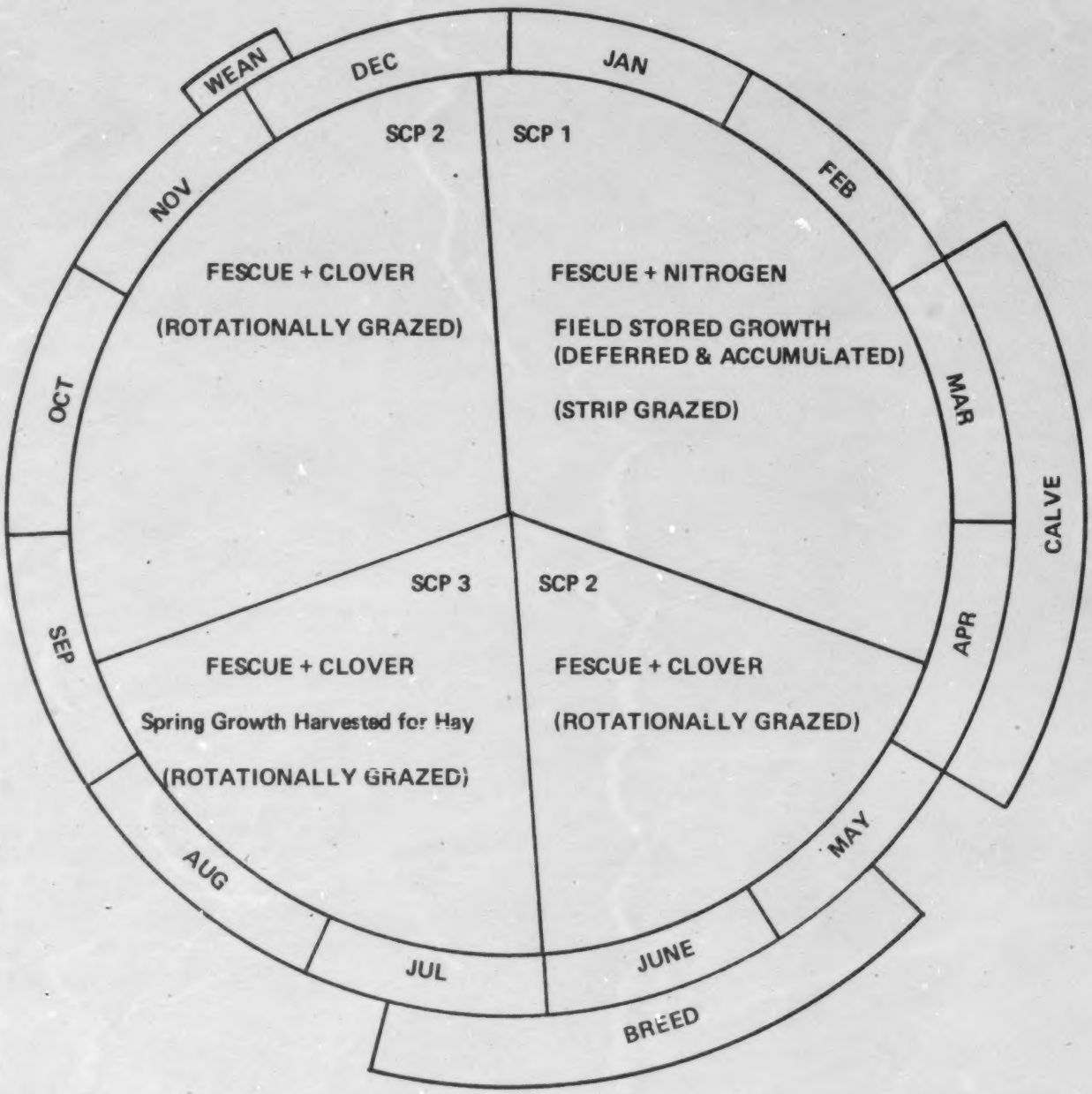
108-2-5

Pasture: Fenced for Strip Grazing
of Deferred and Accumulated Growth

SOURCE: Beef Forage Systems

108-2-6

Cow-forage Calendar Clock



SOURCE: Beef Forage Systems

108-2-7

Lesson 3

HARVESTING AND STORING HAY IN BARNS

Objective -- To develop the effective ability of farmers to harvest and store forages in barn-type structures.

Problem and Analysis -- How can we harvest and store forages in barn-type structures?

-Reasons for storage in barns
-Cutting and conditioning hay
-Raking hay
-Baling and loading hay
-Storing hay

Content

I. Reasons for Storage in Barns

A. Many types of structures can be utilized for barn storage.

B. Tests have shown that about 68% of the food value of the green plant can be preserved.

C. Barn storage of baled hay requires less space than some methods because of compaction of bales.

D. Barn storage has become the traditional method, and most farmers are knowledgeable and experienced with this method.

II. Cutting and Conditioning Hay

A. When to cut

1. Early-cut hay is more palatable, higher in food value (protein, minerals, vitamins) and higher in moisture content than more mature hay.

2. Mature-cut hay is higher yielding, requires fewer cuttings and is easier to cure.
3. Maximum yields and optimum feeding value cannot be obtained at any given time, therefore, a farmer must compromise.
4. Both yield and quality are considered best when hay is cut according to the following table:

Kind of Hay	Best Time for Cutting
alfalfa	one-tenth bloom
alsike clover	full bloom
bromegrass	boot or early head stage
cowpeas	when first pods have started to bloom
crimson clover	one-half bloom
ladino clover	full bloom
lespedeza	early bloom
orchard grass	fully headed
reed canary grass	when first heads appear
small grains	when grain is just past the milk stage
soybeans	when beans and pod are half developed
sweet clover	when first blossoms appear
timothy	early bloom
*red clover	early bloom
white clover	early bloom

5. Some forage specialists recommend cutting alfalfa by the calendar. In Kentucky, one should begin cutting at early bloom (late April to mid-May) and continue cutting at 35-40 day intervals. This will allow one to cut alfalfa four times per year, once the crop is well established.
6. One U.S.D.A. report shows that preventing rain damage on hay can save 18% of the protein. Farmers can use equipment to speed the haymaking process in order to prevent weather damage. A keen weather eye and use of five day forecasts are also beneficial in preventing weather damage. During prolonged, wet-weather periods, some farmers cut hay on a day they are sure it will rain in order to bale it the next few days when the weather should clear. (Less damage is done if hay is rained on before

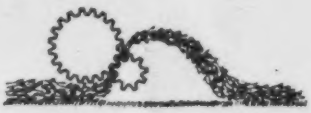
*Red clover is the number one hay crop in Kentucky.

it begins to cure.)

B. Cutting and conditioning hay
   1. The tractor-mounted mowing machine is an inexpensive hay-cutting machine.
      a. The sickle should be sharp and all cutting parts in working condition in order to speed the cutting operation.
      b. If the tractor is large enough, a hay conditioner can be hooked behind the mower in order to perform both operations in one trip over the field.
   2. The hay conditioner should be used before hay begins to wilt in order to break the stems and move through the hay better.
      a. Smooth rollers do a better job by breaking stems along their entire length.
      b. Corrugated rollers (crimpers) only break the stems at intervals.

Comparison of Smooth and Corrugated Rollers

Machines with one steel roll and one rubber roll bruise the stems throughout the entire length, to allow more rapid drying.



The crimp roll machine crushes and bends stems at frequent intervals along their length.

   3. Mower and conditioning machines are available which will perform the additional function of windrowing.
      a. Some of these units are self-propelled and others are pulled by farm tractors.
      b. These machines that have a reel above the cutterbar are especially helpful in cutting hay that is down or hay that has combined clippings in it.
   4. The flail-type cutter-conditioner cures hay faster than the other methods, but tests have shown that field losses are greater.
      a. The mangled stems and leaves are sometimes missed by the rake and are, therefore, lost in the harvest. This

is especially true when cutting legumes.

b. This machine also works well in "down" hay or hay that has combine clippings in it.

III. Raking Hay

A. Side-delivery rakes of various types are available for raking hay.
   1. One should select a rake that has adequate RPM's to roll the hay in an even windrow, if the rake is wheel-driven.
   2. Power take-off rakes allow the driver to select his RPM's in relation to ground speed.
   3. Rakes can be hooked in tandem for quicker raking of large acreages.
   4. Raking should not be done when hay is wet, but it is desirable to rake hay before it is completely cured or dry in order to minimize leaf losses.

B. Some hay conditioners and cutter conditioners have windrowing attachments which, if used, can eliminate the need for raking. If these attachments are used, a wider windrow will permit better hay curing than a narrower windrow with an equal amount of hay in it.

C. A tractor-mounted rake is available that rakes at a 90° angle behind the tractor.
   1. This rake is equipped to fluff-up windrows in order to permit faster drying.
   2. This machine should be quite useful for drying hay that has gotten wet after being windrowed.

IV. Baling and Loading Hay

A. Hay should be baled when the stems have cured enough to feel dry.
   1. Legume stems will tend to break when hay is dry enough to bale.
   2. Plant stems are better indicators of moisture content than are leaves because stems dry later than leaves even after conditioning. If you see no moisture after twisting, baling can begin.

B. The capacity of hay balers should be matched to the amount of hay to be baled within a certain period of time.

C. Twine-tie balers are used most commonly in Kentucky, but if one is selling hay, wire-tie balers may be more desirable.

D. Good quality twine is always more economical than poor quality twine. Both hay and time can be lost from breaking bales and twine not feeding through the baler.

E. Many variations of loading hay are used.
   1. Loading hay and stacking bales on a truck or wagon by hand is the conventional method, but requires a lot of labor.
   2. Some farmers eliminate some labor by pulling a wagon behind the baler and stacking the bales by hand labor. This slows baling and requires a sufficient number of wagons.
   3. Bale throwers attached to the baler eliminate all hand labor in loading. For this method, wagons must be equipped with sides and bales must be made smaller.
   4. Bale loaders are available that can be attached to a truck or wagon to pick up one bale at a time. These machines require hand labor for stacking and someone to drive the power unit.
   5. Self-propelled wagons are available that load and stack bales. These machines will unload the hay in stacks at ground level or one bale at a time into an elevator.

V. Storing Hay

A. Elevators (conveyors) can save labor when taking hay from a wagon or truck into the barn, especially when storage is overhead.
   1. Combination grain and hay elevators are economical if one needs them for both hay and grain.
   2. Hay elevators are lightweight and less expensive than the combination elevators.
   3. Elevators can use power from small gasoline engines, electric motors or tractor PTO's.

B. Almost any structure on the farm can be used for hay storage. Pole barns are most desirable because of low construction costs, ground level to roof storage and ease of conversion for other uses. They are especially adapted for using the self-propelled wagons (stack wagons).

C. Most baled hay should be stacked on its narrowest side in order to prevent damage from bales fitting together too tightly. This is sometimes referred to as "edging."

D. Some farmers are dropping bales from the elevator and leaving them in place. This requires some extra storage space, but adding extra storage may be less expensive than hiring labor to stack the bales.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. Ask the class members the following questions:
a. Why do you feed hay instead of another forage?
b. What do you dislike most about harvesting and storing hay?
c. What can we do to alleviate this problem?
2. Show the first transparency entitled "Hi Guys."

B. Things to be brought out by class members:
1. A desire to harvest and store high-quality hay.
2. A desire to substitute machinery for labor in harvesting and storing hay.
3. An interest in knowing how machinery can help accomplish both of the above.

II. Conclusions

A. Hay can be stored in almost any type of farm building.

B. One can only expect to save about 68% of the

value of the green plant when harvesting and storing hay.

C. One should cut hay at the proper stage of growth in order to preserve the most food value. One must reach a compromise between yield and quality when cutting hay.

D. Conditioning hay permits a farmer to avoid losses due to rain and leaf shattering.

E. Machines can replace much of the labor in storing hay. Machinery should be selected according to a long-range estimate of the amount of hay to be harvested and the amount and cost of labor.

F. New buildings should be designed for saving labor in storing hay.

III. Enrichment Activities

A. Ask class members who are using labor-saving machines to discuss the advantages and disadvantages in using them.

B. Work with others in the county in developing a hay-harvesting demonstration. Invite various machinery representatives to participate. Hold the demonstration on a class member's farm.

C. Secure list prices of various machines that will be discussed in class.

D. Investigate the possibility of class members leasing the equipment.

E. Take class members to field days where machinery will be demonstrated.

F. Invite local dealers to discuss their machinery with class members.

IV. Suggested Teaching Materials

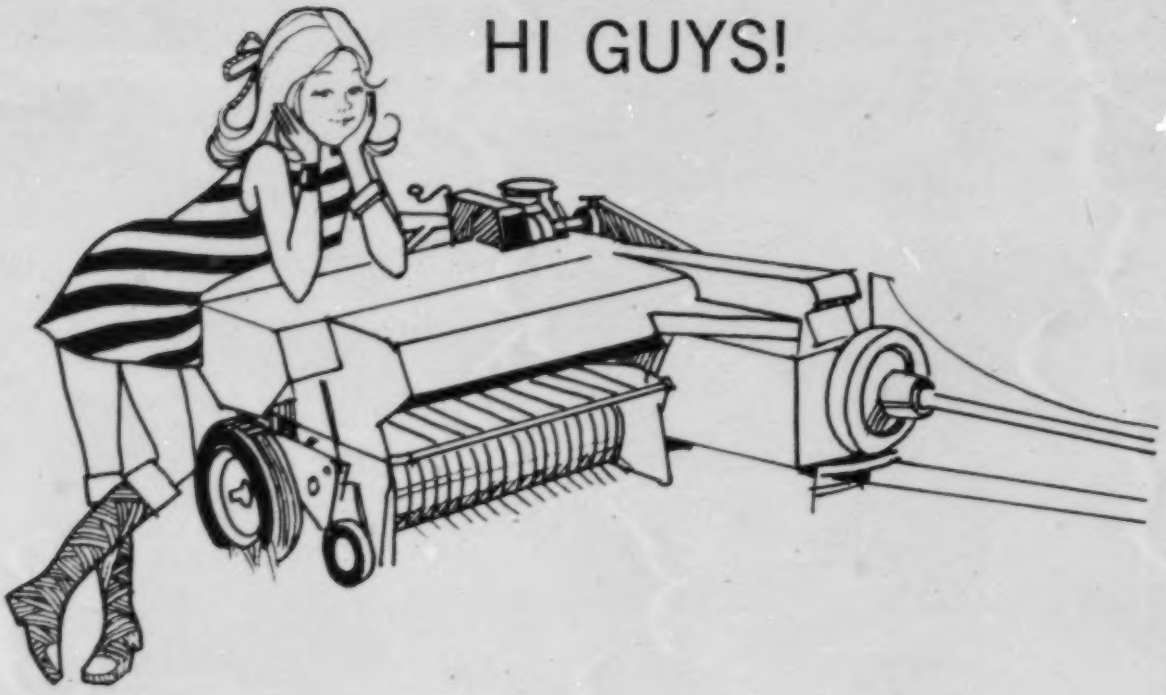
A. References for Lesson 3:

1. Crop Production, Delorit and Ahlgren, pp. 510-520, 524-526, 530-532.
2. Doanes Farm Management Guide, pp. 139-140.

3. Farm Utility Buildings, American Association for Agricultural Engineering and Vocational Agriculture (order from U.K. Instructional Materials Laboratory.).
4. Field Mowers, American Association for Agricultural Engineering and Vocational Agriculture (order from U.K. Instructional Materials Laboratory.).
5. Haying Record Book, New Holland (some useful tips on operating hay balers).
6. Haymakers Handbook, New Holland.
7. Haymakers Handoook Teaching Kit, New Holland. (Contains most of the references listed plus slide set and transparency masters. Cost is $3.00.).
8. Open Hay Storage Building, Plan No. 5879, U.S. Department of Agriculture (available from county Extension Agent or U.S. Department of Agriculture, Agricultural Engineering Research Division, Plant Industry Station, Beltsville, Md.)
9. Pole-Barn Storage of Hay, New Holland.

B. Resource personnel
   1. Cooperative Extension Forage Specialists
   2. Commercial Machinery Representatives
   3. For specific personnel, see VoAg Directory of Resource People in Kentucky.

C. Audio-visuals
   1. Slides
      a. Haymaking, New Holland (available on loan from University of Kentucky Instructional Materials Laboratory).
   2. Masters
      -1 Hi Guys
      -2 Discussion Guide
      -3 Conditioning Locks-in Hay Quality
      -4 Maximum Quality at This Point
      -5 Why Hay Fits into Cropping System
      -6 High Capacity Features
      -7 Would You Buy a Bale Thrower
      -8 One-Man Bale Handling
      -9 Harvesting
      -10 Comparison of Smooth and Corrugated Rollers



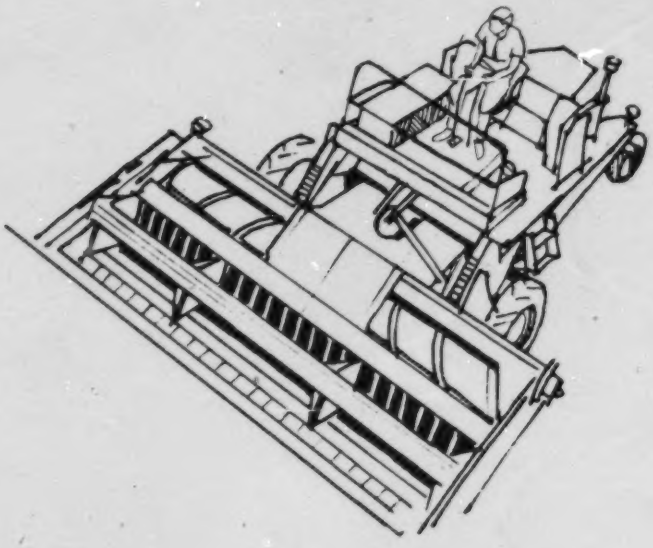
Can I help you study

Harvesting and Storing Forages in Barns?

SOURCE: Haymaker's Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

DISCUSSION GUIDE—HARVESTING EQUIPMENT

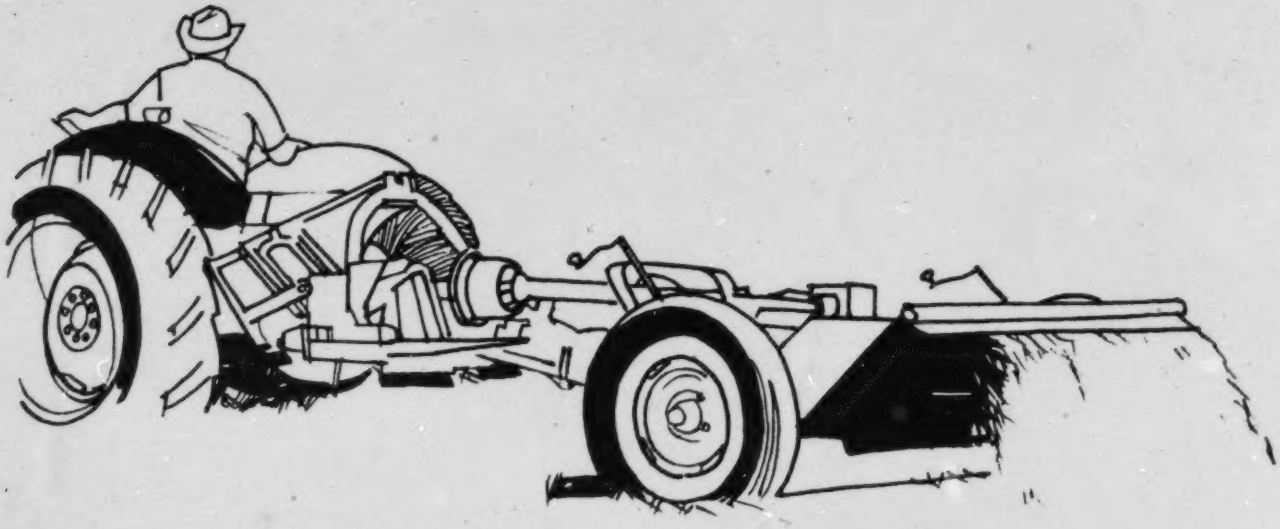
	Use	Development	Cost/Acre	Acres/Hour
Mowers				
Conditioners				
Rakes				
Balers				



SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

CONDITIONING LOCKS-IN HAY QUALITY

1. 1½ tons of water must be removed/acre
2. Crimpers or conditioners dry hay 40% faster
3. Saves leaves
4. Retains feeding value
5. Stems more palatable
6. Reduces baler power requirement



SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

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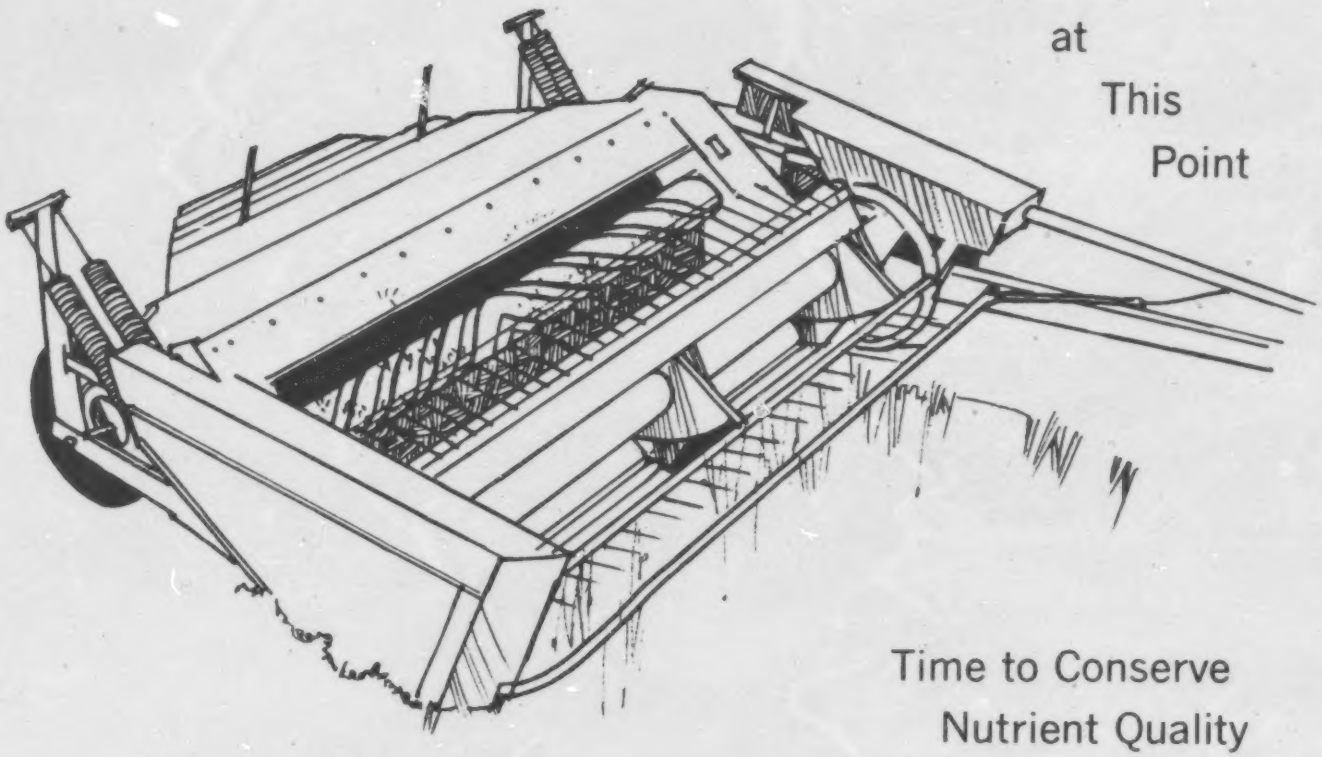
Maximum
Quality
at
This
Point



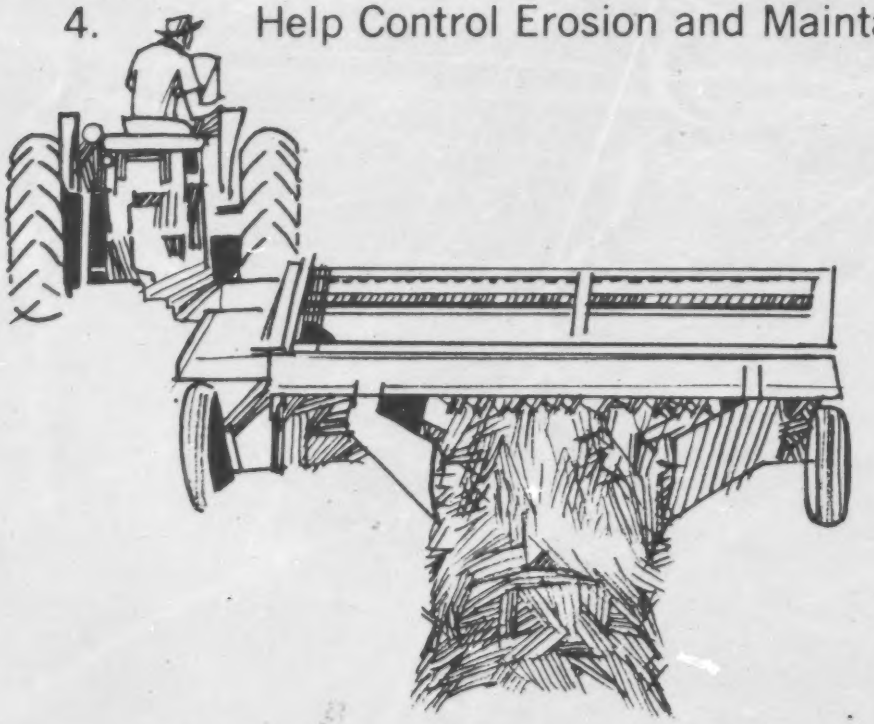
Time to Conserve
Nutrient Quality

SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

108-3-4

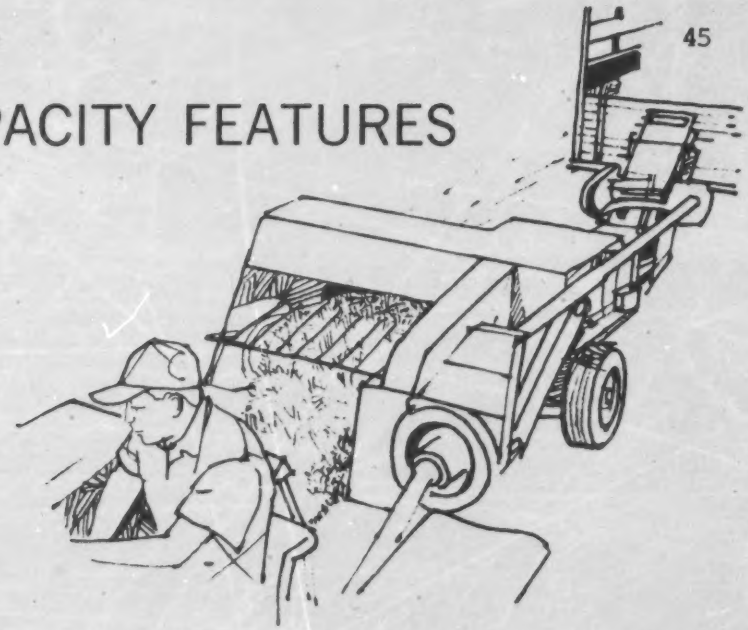
WHY HAY FITS INTO THE CROPPING SYSTEM

1. Treat as High Profit Crop
2. Complementary to Grain Crops
3. Low Cost Source of High Nutrient Feed
4. Help Control Erosion and Maintain Soil



SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

HIGH CAPACITY FEATURES



a. High Capacity Pickups

b. Effective Feeding Mechanisms

c. High Speed Plunger

d. Heavy Duty Knotters

e. Bale Control

f. Power Train Protection

SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

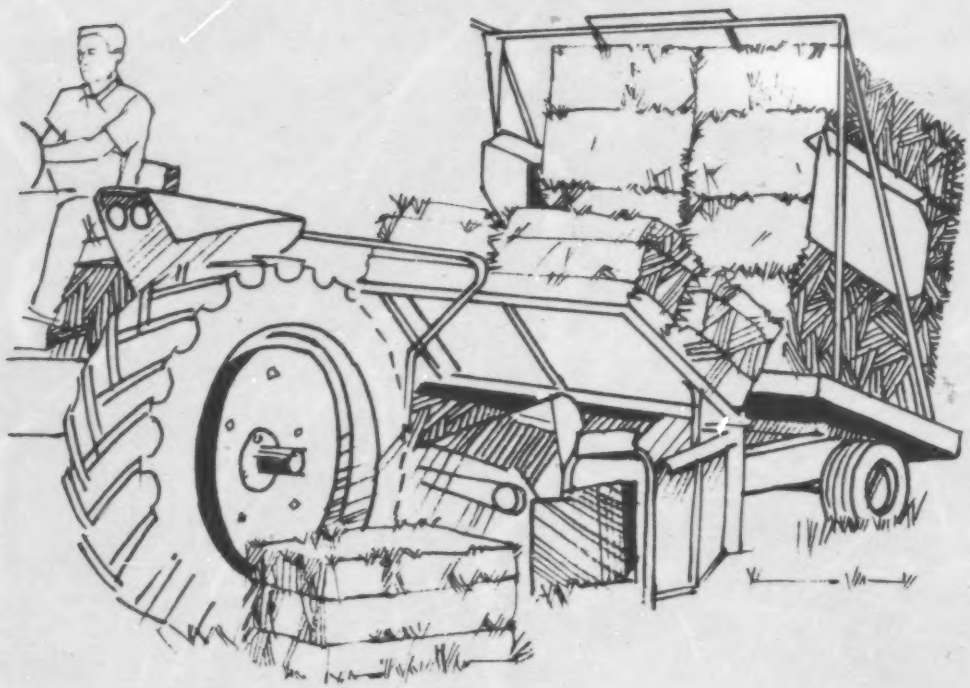
WOULD YOU BUY A BALE THROWER UNDER THE FOLLOWING CONDITIONS?

Labor cost—$2.00 per hour
Bale thrower cost—$500
Hay acreage--200 acres
3 cuttings/season
300 hours per year stacking time

SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

108-3-7

1 MAN BALE HANDLING



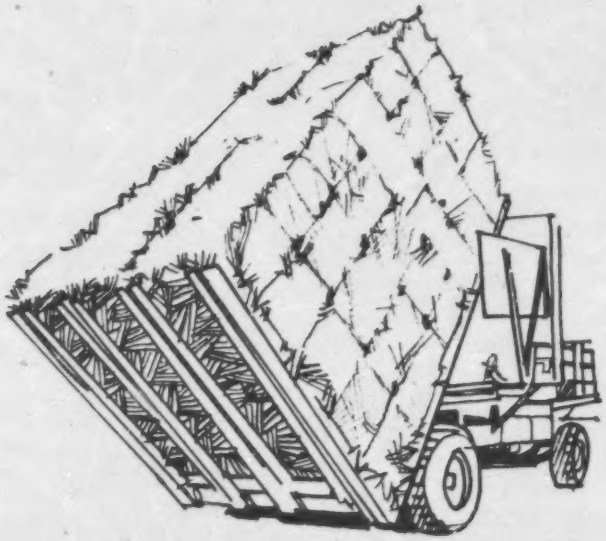
Advantages

1.

2.

3.

SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.



HARVESTING

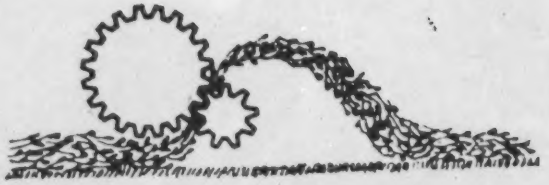
1. A New Look at Hay Harvests
2. Plan for Better Bale Handling
3. Map Out Your Hay System
4. Cutting Knowhow Pays Off
5. Conditioning Locks in Hay Quality
6. Get the Most Out of Haying Equipment
7. Tips on Hay Harvest Systems

SOURCE: Haymakers' Handbook Teaching Kit, New Holland Division of Sperry-Rand Corp.

108-3-9

Comparison of Smooth and Corrugated Rollers

Machines with one steel roll and one rubber roll bruise the stems throughout the entire length, to allow more rapid drying.



The crimp roll machine crushes and bends stems at frequent intervals along their length.

Lesson 4

HARVESTING AND STORING SILAGE

Objective -- To develop the effective ability of farmers to harvest, store, and feed silage.

Problem and Analysis -- How can we harvest, store, and feed forages as silage?

-Reasons for using silage
-Harvesting silage
-Storing silage
-Feeding silage

Content

I. Reasons for Using Silage

A. Plant-nutrient losses are less when plants are harvested as silage than as hay.

B. Palatibility of poor-quality forage can be improved by processing as silage.

C. Silage can be made when weather is not favorable for making hay, especially in early summer.

D. Weeds and their seeds are better controlled by harvesting forage as silage.

E. Silage readily lends itself to mechanization.

F. Less storage space is required for silage than is required for hay.

G. More nutrients can be harvested per acre with corn silage than any other forage crop.

Estimated Net Energy (ENE) and Crude Protein (CP) per Acre, from Corn and Alfalfa-Grass Forages*

	ENE (Therms)	CP (Lb)
Corn, 100 bu grain per acre	4,480	487
Corn, 20 tons of silage per acre	7,600	920
Alfalfa-grass forage, 5 tons of hay per acre		
Alfalfa-grass hay (bud stage)	4,350	1,800
Alfalfa-grass hay (mid-bloom)	3,820	1,400
Alfalfa-grass forage, 3 tons of hay per acre		
Alfalfa-grass hay (bud stage)	2,610	1,080
Alfalfa-grass hay (mid-bloom)	2,290	840

II. Harvesting Silage

A. Time of harvesting

1. Corn silage

a. Corn should be harvested when the grain is in the dent stage (32-36% DM). (Refer to master 108-4-2.)

b. A good rule of thumb is to harvest corn seven weeks after silking.

c. Early harvesting (above 70% moisture) causes leaching of nutrients after storage.

d. Excessively dry corn does not pack well and allows air to enter forage, causing spoilage.

2. Grass silage

a. Forages should be from 30% to 35% dry matter when storing in an upright silo. Wilting is usually necessary, so cut at the proper time and cure properly to preserve the maximum food value. The grab test shown on master #108-4-4

* SOURCE: Michigan State University, Dairy Department

can help on to determine moisture content.

Stages of Maturity for Grass Silage*

	Stage of Maturity	Approximate Dry-matter Content at Cutting	Hours of Sun-Wilting before Ensiling
		% %	
Alfalfa	½ bloom	22 - 27	2 - 3
Red clover	½ to full bloom	23 - 28	2 - 3
Korean lespedeza	½ to full bloom	30 - 35	0 - 1
Soybeans	pods 3/4 filled	23 - 28	2 - 3
Cowpeas	first pods filled	16 - 21	3 - 4
Sweet clover	½ to full bloom	20 - 25	3 - 4
Bluegrass	before bloom	25 - 30	0 - 1
Timothy or orchard grass	before bloom	25 - 30	1 - 2
Cereals	early milk stage	22 - 27	2 - 3

b. Grasses should not be wilted before storing in a horizontal silo. The extra moisture is needed for packing, and there will be little runoff because of less pressure from weight of the crop.

c. If small grains are harvested as silage in a double cropping program, the desired time of planting of the next crop should determine the time to harvest the small grain.

B. Chopping silage

1. Silage should be cut in 3/8" to 1/2" lengths for good packing.
2. Adequate equipment for fine chopping must be used.
3. Fine chopping reduces waste when feeding.
4. Fine-chopped silage flows better through the silo and feeding equipment than does coarse-chopped silage.
5. Chopper knives and shearbar corners must be

* SOURCE: Making and Feeding Grass Silage

kept sharp for fine chopping.

III. Storing Silage

A. Horizontal silos

1. Silage should be unloaded in layers and packed continuously with a heavy tractor.
2. Wide, deep silos have less spoilage than narrow shallow silos.
3. Careful attention must be given to packing the sides.
4. If urea is to be added to corn silage, 10 lbs./ton should be spread over the top of the load of a side-unloading wagon or use a metering device on the chopper or spread with cyclone seeder over silage in the silo. The latter method requires mixing with a blade before packing.
5. The silo should be covered securely with plastic that is weighted down in order to keep the wind from blowing it off.

B. Upright silos

1. An adequate blower is essential for fast unloading. The blower may be equipped with a metering device for mixing, additives and/or preservatives.
2. Except under optimum conditions, preservatives are needed for grass silage in upright silos. The following is a suggested rate of application for preservatives:

Rate of Preservative Application for Silage*

Straight legumes or mixtures high in moisture (80%)	Rate of application per ton
Molasses (cane)	100 lb.
Corn and cobmeal	200 lb.
Citrus pulp	250 lb.
Beet pulp	250 lb.
Sodium bisulfite	10 lb.
Kylage	5 lb.

cont.

Rate of Preservative Application for Silage - contd.

Legume grass mixtures (40% legume) or mixtures medium in moisture content (75%)	Rate of application per ton
Molasses (cane)	80 lb.
Corn and cobmeal	150 lb.
Citrus pulp	200 lb.
Beet pulp	200 lb.
Sodium bisulfite	9 lb.
Kylage	4 lb.
Straight grasses or mixtures low in moisture content (70%)	
Molasses (cane)	60 lb.
Corn and cobmeal	100 lb.
Citrus pulp	150 lb.
Beet pulp	150 lb.
Sodium bisulfite	8 lb.
Kylage	3 lb.

3. Urea may be spread on top of the load before unloading (10 lbs. of urea per ton of corn silage).
4. A spreader on top of the blower will aid in uniform filling and allow more silage to be stored in the silo.
5. Low-moisture silage (less than 65% moisture) must be stored in air-tight silos. Extra management is required, but less material is handled and more nutrients can be stored in the silo.

C. Stacking silage
1. Some farmers are successfully stacking silage on top of the ground.
2. Stacking is helpful when more feed is produced or needed than existing structures will hold.
3. A well-drained, solid site should be selected.
4. Care should be taken to pack the silage,

* SOURCE: Grass Silage Preservatives, Rutgers University.

especially on the sides.

5. A plastic cover should be used to cover all of the silage and weighted to keep it in place.
6. Usually, stacks should be fed before other silage is fed.

IV. Feeding Silage

A. Unloading silage

1. Horizontal silos and stacks can be unloaded with any tractor-mounted loader that is in use on the farm.
2. Upright silos should be designed for either top or bottom unloading. Bottom unloading allows one to feed the forage in the order that it was stored. Top-unloaded silos must be emptied before the older silage can be fed.

B. Feeding structures

1. Silage can be fed from trailers with mounted feed troughs. These can be pulled from silo to the feeding area and thus eliminate extra handling.
2. Silage can also be hauled in silage wagons and unloaded into fence-line bunkers.
3. Stationary feed bunk can be filled automatically with auger, chain, roller, bed, or shuttle conveyors. Some farmers install barn cleaning equipment to move silage because of its rugged construction.
4. Self-feeding bunkers can be designed at the base of the silo. Some rotate around the silo and others are constructed in the base of the silo. (Refer to masters #6 and 7.)

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:

1. Ask class members the following questions:
   a. What method of forage harvesting and storage reduces labor and weather problems the most?
   b. What forage crop will yield the most

feed per acre?
c. How can one harvest and preserve almost all of his forage crop?
d. How much feed must be used in order to justify silage feeding?
e. Will your farm grow silage crops?

B. Things to be brought out by class members:
1. If the initial cost of silage feeding is a deterrent
2. Choices of different silage feeding systems
3. Needs for automation in harvesting and storing forages

II. Conclusions

A. Silage comes nearer to preserving all the food value of plants than any other forage storage method.

B. Silage storage can reduce labor required in storing and feeding out forages.

C. There are fewer weather problems when storing forage as silage.

D. Silage should be stored at about 35% dry matter. Usually grass silage needs to be wilted. A preservative may be added when one is unsure of his skill in making silage.

E. Silage should be cut in 3/8" to 1/2" lengths to allow for proper packing.

F. Horizontal silos are usually less expensive to construct than upright silos, but require more labor in feeding and have more spoilage. The latter point may rule out this system in future years.

G. The feeding system is dictated by the type of storage structure used.

III. Enrichment Activities

A. Invite a forage or crops specialist to speak to the class.

B. Preserve some forage in a sealed fruit jar a few months before class is to be held and discuss what happened to it when you examine the forage.

C. Invite local farmers who use different methods of silage storage to discuss their experiences with the class.

D. Take a field trip to see different silage systems.

IV. Suggested Teaching Materials

A. References for Lesson 4

1. Approved Practices for Forage Crops, Penn State University, pp. 4-5, 8.
2. Concrete Improvements for Farm and Ranch, Portland Cement Association, pp. 24-26, 36-40.
*3. Corn Silage for Dairy Cattle, University of Kentucky, pp. 6-8, 10-15.
*4. Crop Production, Delorit and Ahlgren, pp. 534-553.
*5. Doane's Farm Management Guide, Doane Agricultural Service, pp. 141-144.
6. Grass Silage Preservatives, Rutgers University.
7. Haylage Silage Handbook, New Holland pp. 8-20.
8. Horizontal Box Silos, U.S. Steel (plans for building with creosoted wood).
9. Low Moisture Silage, Rutgers University.
10. Self-Feeder Tower Silos, Rutgers University.
11. Structures and Environment Handbook, MWPS-1.

B. Resource personnel

1. Consult area Extension Specialists
2. Mr. Harold Vaught, Extension Specialist in Crop Production, Mammoth Cave Area, Federal Building, Bowling Green, Ky. 42101.
3. Mr. Warren Thompson, Extension Specialist, University of Kentucky, Lexington, Ky.
4. For specific personnel, see Vo-Ag Directory of Resource People in Kentucky.

C. Audio-visuals

1. Masters
   -1 Values of Silage
   -2 ENE and CP from Corn and Alfalfa

* Indicates most useful references.

-3 Stages of Maturity for Grass Silage
-4 The Grab Test
-5 Application of Urea
-6 Self-Feeder Silo
-7 The Lazy-Susan Self Feeder

2. Film
   a. "Use-It-All-Beef," A.O. Smith, Harvestore Products, Inc. (available from
      Venard Films
      Box 1332
      Peoria, Ill. 61601)

VALUES OF SILAGE

1. Reduced nutrient loss
2. Improved palatibility
3. Harvesting in unfavorable weather
4. Control of weeds
5. Easily mechanized
6. Reduced storage space
7. Higher nutrients per acre

Estimated Net Energy (ENE) and Crude Protein (CP) per Acre, from Corn and Alfalfa-Grass Forages

	ENE (Therms)	CP (Lb)
Corn,		
100 bu grain per acre	4,480	487
Corn,		
20 tons of silage per acre	7,600	920
Alfalfa-grass forage.		
5 tons of hay per acre		
Alfalfa-grass hay (bud stage)	4,350	1,800
Alfalfa-grass hay (mid-bloom)	3,820	1,400
Alfalfa-grass forage,		
3 tons of hay per acre		
Alfalfa-grass hay (bud stage)	2,610	1,080
Alfalfa-grass hay (mid-bloom)	2,290	840

SOURCE: Michigan State University, Dairy Department

108-4-2

Stages of Maturity for Grass Silage

	Stages of Maturity	Approximate Dry-matter Content at Cutting	Hours of Sun-Wilting before Ensiling
		% %	
Alfalfa	¼ bloom	22 - 27	2 - 3
Red clover	½ to full bloom	23 - 28	2 - 3
Korean lespedeza	½ to full bloom	30 - 35	0 - 1
Soybeans	pods 3/4 filled	23 - 28	2 - 3
Cowpeas	first pods filled	16 - 21	3 - 4
Sweet clover	½ to full bloom	20 - 25	3 - 4
Bluegrass	before bloom	25 - 30	0 - 1
Timothy or orchard grass	before bloom	25 - 30	1 - 2
Cereals	early milk stage	22 - 27	2 - 3

SOURCE: Making and Feeding Grass Silage

THE GRAB TEST

MOISTURE MOST IMPORTANT!

The moisture content of the crop at the time of ensiling is the most important factor in determining the extent and type of the losses through seepage and fermentation, and the quality of the silage produced.

CHECK MOISTURE OF CROP WITH THE GRAB TEST

Squeeze tightly for 90 seconds a handful of fine-cut crop. Release your grip and note the condition of the ball in your hand. This will indicate the treatment needed.

Over 75% moisture when juice runs freely. This is too wet to make high-quality silage without treatment or wilting. Seepage losses will be high.

70% to 75% moisture when the ball holds its shape and the hand is moist. With no treatment there will be seepage losses and some strong odors.

60% to 70% moisture when ball expands slowly and no dampness appears on the hand. This is the best condition for ensiling without preservatives.

Under 60% moisture when the ball springs out upon opening the hand. Silage is very likely to be moldy unless wetted down or layered with wet crops.

SOURCE: Grass Silage Preservatives, Rutgers University
108-4-4

PAGES 63-65 OF THIS DOCUMENT WAS REMOVED PRIOR TO ITS BEING SUBMITTED TO THE ERIC DOCUMENT REPRODUCTION SERVICE BECAUSE IT WOULD NOT REPRODUCE IN MICROFICHE.

Lesson 5

HARVESTING AND STORING FORAGES IN THE FIELD

Objective -- To develop the effective ability of farmers to harvest, store and feed forages in the field.

Problem and Analysis -- How can we harvest, store and feed forages in the field?

-Need for field storage
-Preparing the crop for harvesting
-Small round baler
-Large round balers
-Large stacks

Content

I. Need for Field Storage

A. Higher costs of building materials have increased the cost of storing forages in enclosures.

B. Field storage eliminates much of the labor and machinery required for storing and feeding forages in enclosures.

C. Much time can be saved by storing forages in the field. Time is a critical factor in harvesting quality hay.

D. Because of the savings in labor and storage space, lower value crops and crop residues can be harvested. This increases the total amount of feed produced on the farm. However, this is an excellent system to store fine quality hay crops.

E. It is also an excellent method of storing high-value forage crops. Good management is needed in order to secure well-shaped, dense stacks.

II. Preparing the Crop for Harvesting

A. Cutting, conditioning and raking can be done in a similar manner to barn storage. (Refer to Lesson 3.)

B. Conditioning is as desirable for field storage as barn storage. Keep in mind you are after quality feed.

III. Small Round Baler

A. This machine costs about the same as a conventional hay baler.

B. Bales weigh approximately 40 lbs. Twine is required for wrapping around bales.

C. Baler can be pulled with a small tractor (25 or more HP). A live PTO is highly desirable.

D. Moisture of hay should be about the same as for conventional baling.
   1. Windrows must be wide in order to feed evenly across table, and thus form good bales.
   2. Most farmers rake double-windrows to lay side by side.
   3. The tractor must be stopped after each bale is formed to allow time for wrapping of twine around bales.

E. Hay must be moved by truck or wagon to another area if more hay is to be cut from the field later. Most farmers leave bales where they drop, graze the regrowth, and permit cows to eat the hay when it is needed.

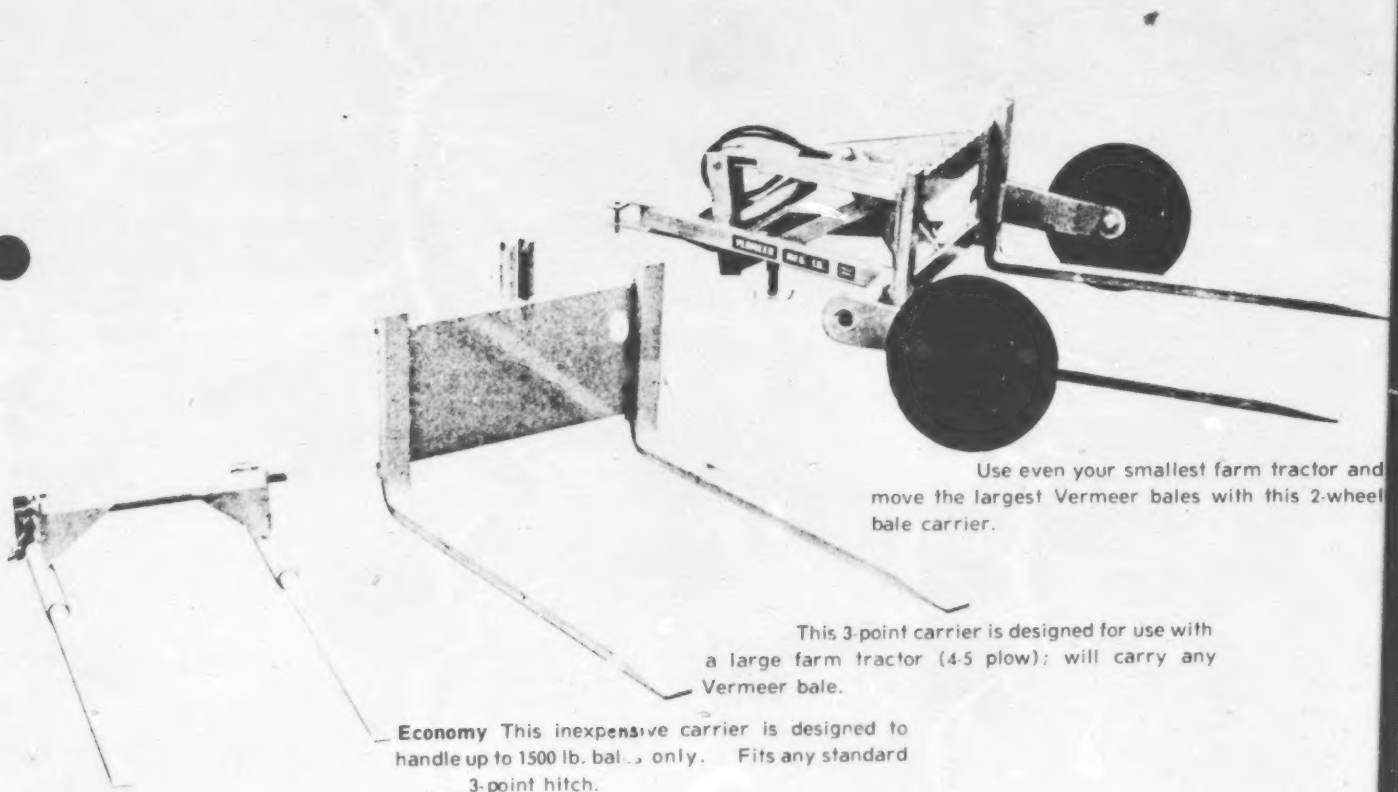
IV. Large Round Balers

A. Machines that make a 5' x 6' bale weighing up to 1,500 lbs. cost slightly more than a conventional hay baler. Machines are available that make a 6' x 7' bale.
   1. Smaller machines require a 45 HP tractor, while the larger machine requires a 60 HP

tractor. A remote-control hydraulic system is required and a live PTO is desirable.

2. Moisture should be about the same as for conventional baling.
3. The baler must be driven in a weaving motion across windrows in order to form a good bale.
4. This machine moves faster through hay than a conventional hay baler, but one must stop after the bale is formed for twine wrapping and unloading. Twine isn't needed if bales will not be moved.

B. Bales may be moved to an outdoor storage (Hay yard) area with the following bale carriers:



Use even your smallest farm tractor and move the largest Vermeer bales with this 2-wheel bale carrier.

This 3-point carrier is designed for use with a large farm tractor (4-5 plow); will carry any Vermeer bale.

Economy This inexpensive carrier is designed to handle up to 1500 lb. bales only. Fits any standard 3-point hitch.

Note: Although a brand name is listed, no endorsement is intended.

c. Bales may be fed from a portable rack in order to prevent cattle wasting or damaging the hay. Otherwise, you must restrict the number of bales available to the cattle.

The 1500 lb. bale is sufficient feed for 25 cows and calves for 4 days. If feeding 50 cows, put out only 2 bales at a time each 4-5 days or as needed.

V. Large Stacks

NOTE: Some machines that stack hay are not designed to compress hay tightly. It appears that stacks need to be compressed in order to minimize weather damage in this area. Therefore, this section only deals with machines that compress with hydraulic power.

A. Machines are available that make 1½ ton, 3 ton and 6 ton stacks.
   1. These machines vary in cost, but they cost considerably more than a conventional hay baler.
   2. The 1½ ton machines require a 40HP tractor, 3 ton machines require a 60 HP tractor, and 6 ton machines require a 80 HP tractor.
   3. Tractors for each machine require a dual, remote-control hydraulic system.

B. Hay can be stacked at a slightly higher moisture content than is required for baling.
   1. Stacks will be formed better if 1½ ton and 3 ton machines are driven by weaving across the windrow. The 6 ton machine has an oscillating spout and does not have to be driven in a weaving pattern.

NOTE: The 6 ton stack has limited use in Kentucky. Stick to 1½-3 ton limit for best results.

2. The tractor must be stopped each time the hay is compressed.
3. Each stack should be compressed from four to seven times, depending upon moisture content of the hay. The 1½ ton unit may require more.
4. Unloading is usually done in the field on site or the stack can be moved to a storage location before unloading, if desired.

C. The 1½ ton stacks can be moved with a mounted stack mover on a 50 HP tractor. Larger stacks require a tandem-wheel stack mover.
1. This machine can be purchased with a feeding attachment that will slice and unload the hay in the field or in feed bunks.
2. Stacks can be fed free choice, with feeder panels or with electric fences.
3. One should select a feeding area that is well-drained and offers solid footing for livestock.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher. Ask class members questions such as the following:
1. Can hay be harvested and stored outside in the weather?
2. What have been the experiences of farmers who have stored hay outside?
3. What are some advantages to be gained by storing hay outside?
4. Does one need to handle hay differently during harvesting if it is to be stored outside?

B. Things to be brought out by class members:
1. Objections to outside storage of hay.
2. Cost of machinery needed for outside storage.
3. Feeding problems that must be considered when deciding how to store hay outside.

II. Conclusions

A. Field storage of forages can reduce feeding

costs by reducing building storage costs, reducing labor costs, saving time, and increasing the total amount of forages produced on the land.

B. Usually the same equipment can be used in cutting and raking for field storage as is used when storing baled hay. In most cases, however, field-stored hay should not be conditioned.

C. Small round bales are made by an inexpensive machine, but more time is required in harvesting. Hay must be moved if the field is to be harvested again.

D. The large round bales are made at a reasonable cost, can be harvested quickly, and should preserve hay well. Hay can be moved mechanically.

E. Large stacks are more expensive to make and move because of the cost of the machines. Large stacks should reduce spoilage and can be adapted to many types of feeding.

III. Enrichment

A. Invite machinery representatives to discuss features of their equipment.

B. Attend a field day where field storage machines will be demonstrated.

C. Visit a farm where field storage of forages is practiced.

D. Secure price lists of various kinds of equipment used in field storage.

E. Help sponsor a field day in your area and invite machinery representatives to demonstrate their machines.

F. Invite a specialist to speak to the class about field storage.

NOTE: Because field storage of forages is in its infancy, the teacher should learn of new machines that will soon be on the market.

IV. Suggested Teaching Materials

A. References for Lesson 5:
1. Hesston Stack-Hand Systems and The Care and Feeding of Hesston Hay Stacks, both available from Hesston Corporation, Hesston, Ks. 67062.
2. Vermeer Hay Balers, available in quantities from Vermeer Manufacturing Company, Pella, Iowa 50219.

B. Resource personnel
1. Dr. Curtis Absher, Extension Specialist in Beef Cattle, Princeton, Ky.
2. Mr. Don Bruce, Hesston Sales Representative, Campbellsville, Ky.
3. Mr. Charles Goff, Vermeer Sales Representative, Glen Dean, Ky. 40141.

C. Audio-visuals
1. Masters
-1 Large Round Baler
-2 Carriers for Large Round Bales
-3 Feed Rack for Large Round Bales
-4 1½ Ton Stacking Machine
2. Slides
a. Set of 7 slides showing Large Round Baler and Equipment (available from Curriculum Development Center, College of Education, University of Kentucky).
3. Films
a. "Best Move You Can Make," Hesston Corporation (available from:
Venard Films
Box 1332
Peoria, Ill. 61601

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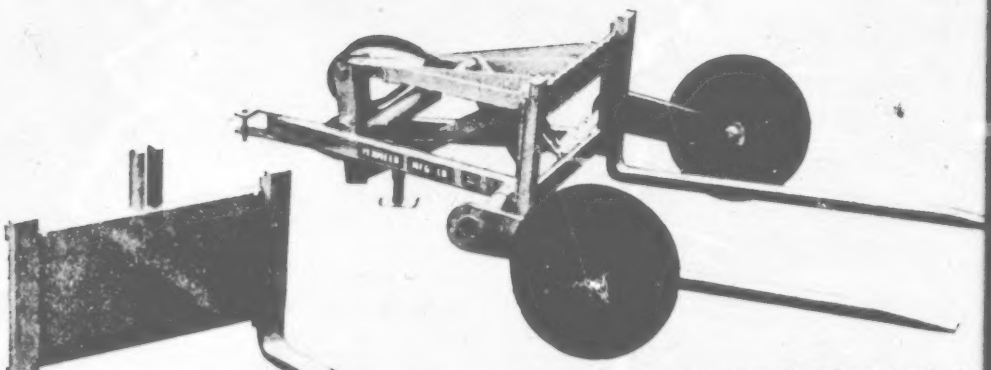
CARRIERS FOR LARGE ROUND BALES



Use even your smallest farm tractor a
move the largest Vermeer bales with this 2-whe
bale carrier.

This 3-point carrier is designed for use with a large farm tractor (4-5 plow); will carry any Vermeer bale.

Economy This inexpensive carrier is designed to handle up to 1500 lb. bales only. Fits any standard 3-point hitch.

SOURCE: Vermeer Hay Balers.

108-5-2

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APPENDIX

MY TEACHING PLAN FOR THIS COURSE

Why I am teaching this course (major learnings or outcomes expected)

ARRANGEMENTS FOR THE COURSE

Session No.	Date	Topic	Clock Hours

This page is for your convenience in planning and rearranging the content of this course to meet local needs and interests. Plan the course as it will be taught in the local school, showing the dates, class session number, topics, and the time in hours allocated to each topic.

TOPIC PLANNING FOR THIS COURSE

Name of Course _____

Name of Topic _____

Number of Class Meetings Allotted for this Topic _____

Teaching Objectives: (Learnings or outcomes for those enrolled)

Major Phases of the Topic: (Problems, jobs, areas, skills, key points, understandings, etc.)

Learning Activities: (Field trips, completing summary forms, panel discussions, demonstrations, etc.)

Teaching Materials Needed: (From resource material list or file)

RESOURCE MATERIALS FOR TEACHING

Unit _____ Lesson _____

Reference Books	Date Used	File Location
Other References: Bulletins, Magazines, Etc.		
Audio-Visuals: Slides, Filmstrips, Motion Pictures		
Magnetic, Flannel, and Bulletin Boards		
Charts, Maps, Posters		
Transparencies		
Specimens, Models, Mounts		
Human and Community Resources		

Please complete and return to:
Maynard J. Iverson
#15 Dickey Hall
University of Kentucky
Lexington, Kentucky 40506

ADULT INSTRUCTIONAL UNIT EVALUATION

-- A Questionnaire for Kentucky VoAg Teachers of Adults

PART I -- GENERAL INFORMATION

How many years of teaching experience do you have? _____

How many years have you taught adults in agriculture? _____

How long has it been since you have taken your last college classwork in agriculture_____; in education _____; (undergraduate, graduate, or non-credit course)? _____

What is the highest degree you hold? _____

How many teachers are in your department?_____

What age level students do you teach? (✓one)
a) ____high school and adult b)_____adult only

How many other units from the University of Kentucky have you used in your teaching during the past few years?_____

PART II -- UNIT INFORMATION

NAME OF UNIT EVALUATED:_____

TYPE OF CLIENTELE TAUGHT: _____Adult Farmer ____Young Farmer
_____Other Adults (please specify)_____

Average number attending class _____

Was the interest level _____high? _____moderate? _____low?

How many lessons did you use?_____ How many class periods?_____

Indicate any lesson you added or deleted_____

_____

_____

_____

Directions: Place a check mark (✓) in the appropriate left hand column to rate the following components of the unit based on your own observations. A ranking of 5 represents an excellent rating decreasing to a rank of 1 for poor. For the open-ended questions please write on the back if additional space is needed.

Unit Design

5	4	3	2	1	
					General arrangement of parts
					Appropriateness of format for teaching adults
					Length of the unit
					Usefulness of suggestions for using the unit
					Number of lessons
					Order of lessons

Specific comments:_____

_____

PLEASE CONTINUE ON NEXT PAGE

Objectives in the Unit

5 4 3 2 1

_____ Clearly stated
_____ Reasonable to reach in the allotted time
_____ Relevant to needs of the adult learner
Specific comments: _____

_____

Technical Content

5 4 3 2 1

_____ Usefulness of introductory material
_____ Sufficiently detailed for direct use in class
_____ Related to objectives
_____ Divided into appropriate problem areas
_____ Up-to-date
_____ Accuracy
_____ Reasonably complete
Specific comments: _____

_____

Suggestions for Teaching the Lessons

5 4 3 2 1

_____ Appropriate information for the teacher to bring out
_____ Appropriate items to be secured from class members
_____ Suitable conclusions
_____ Suitability of enrichment activities
Specific comments: _____

_____

Resources and Teaching Aids in the Unit

5 4 3 2 1

_____ Up-to-date
_____ Accessibility to the teacher
_____ Relevance to the unit
_____ Adaptability to the teaching plan
Specific comments: _____

_____

With what parts of the unit do you feel you need additional help?

____ None of them
____ Objectives
____ Content
____ Course organization and planning
____ References
____ Resources and teaching materials
____ Teaching methods
____ Other (Specify) _____

PART III -- GENERAL REACTION

Please indicate any other strengths and weaknesses that you have observed in the unit and any suggestions for improvement, revision, and/or implementation (use the back of this sheet if needed).